Abstract

Bad visibility conditions which occur due to fog in winters or night time driving are the major causes of road accidents in India. The principal cause for such accidents is the unintentional ignorance of speed breakers which may be due to the driver not being able to detect them or may be due to over speeding of vehicles. This project brings an idea of an intelligent speed breaker system that helps in detecting speed breakers well in time so that such accidents can be avoided. This system makes use of a RF module that warns the person who is driving about the existence of a speed breaker in proximity, with this it assists in automatically reducing the vehicle's speed if no action is taken by the driver in time. Through Internet of Things (IoT), GPS Location (latitude & longitude) of speed breaker can be sent to cloud using GPS and stored on cloud to use it for future to avoid mishaps.

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CHAPTER 1
INTRODUCTION

The main objective of this project is to control the speed of any vehicles in schools, hospitals and speed in restricted regions etc. Smart speed breakers are the traffic claiming devices where over speeding vehicles will activate the speed breaker and it will raise the speed breaker above the surface of the road and will give the physical remainder to the driver for slowing down the vehicle. If the speed of the vehicle will be in the given allowed speed limit, then the speed bumps will remain flat on the surface of the road and the vehicle can pass through it comfortably. In this project the author has discussed that explains to develop Today's traffic safety solution requires all cars to slow down without realizing the speed of the ongoing vehicle, which raises the traffic issue. To prevent this, the device must work according to the speed of the car. In this assembly, the bumps of the smart speed breaker lower into the road surface is elevated above the physical residue. Paper 3: “Automated speed breaker to control speed of vehicle based on IOTIn this paper the author have discussed that addressed that Smart Speed Breaker system with IOT that will surface and only display if the speed of the vehicle is greater than those limits. Arduino board activates a motor to surface the speed breaker mechanism for control of the speed breaker, for use of RTC in real time. The Arduino board sends a signal to the buzzer to start the beep sound to warn the driver according to the speed and distance of the breaker.

India has the world's second largest road network as a developing country. Almost 97,991 km was provided by highways over a total length of 5 million km of road network. Because of its sheer magnitude, the Indian government already faces a great challenge to provide a world class path. A person on average spends from 30 to two hours a day driving anywhere. That's about 360 hours in one year. Imagine what type of stress the individual places on his body and unnecessary burden. Given all this, roads are India's biggest mode of transport. Nearly 90% of transport by passenger and industry is done through roads. The fast-growing population raises traffic, and good traffic management is very necessary for safety and also decreases travel time.

The solution that is now available every day and that is widely used is a nice, but not the best solution. In short, all vehicles are collectively liable and the path dangerous or accessible. When heavy cars and small vehicles are slowed down, more time is needed to regain their previous speed by vehicles as traffic increases. Slow speed cars also get shocks and noise that they are not deserving of. Internet of Things (IoT) is now a critical subject in the technology industry, software engineering, policy and has become important news in both print media and social media. This technology is implemented in a wide variety of networked devices, systems and sensors using advancements in computing power, declining electronics, and networks to manage original competences that are not possible previously. Day by day new topics and analysis on IoT issues abundance of conferences, studies and articles and discussion of the IoT uprising's potential influence from new technology openings and business innovations main concerns about security, privacy.

CHAPTER 2
EXISTING METHOD

2.1: Block Diagram

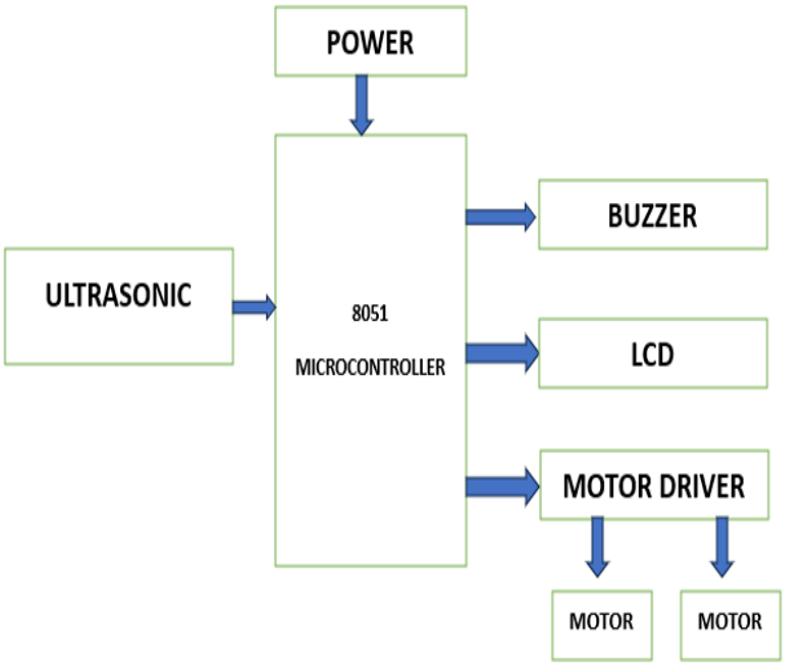


Fig.2.1: Block Diagram of Existing method

In existing method there is no RF Tx/Rx it has only ultrasonic sensor whenever the speed breaker arrives near to vehicle less than 2 meters then only it will detect and process the data but it is very difficult to slow vehicle at high speeds when Vehicle reaches nearer to speed breaker and also if we use ultrasonic sensor, it can't detect the speed breaker if there is any other vehicle Infront of our vehicle.

2.2: Drawbacks

1. Robot Controlling using Ultrasonic sensor.
2. Very less distance to slow vehicle before to reach speed breaker.
3. No data storage.
4. No location sharing features.
5. It is very slow process because of more number of lines in coding.
6. For programming a microcontroller need a very strong foundation on Embedded C & C languages.

CHAPTER 3
PROPOSED METHOD

3.1: Block Diagram

3.1.1: Speed Breaker Section

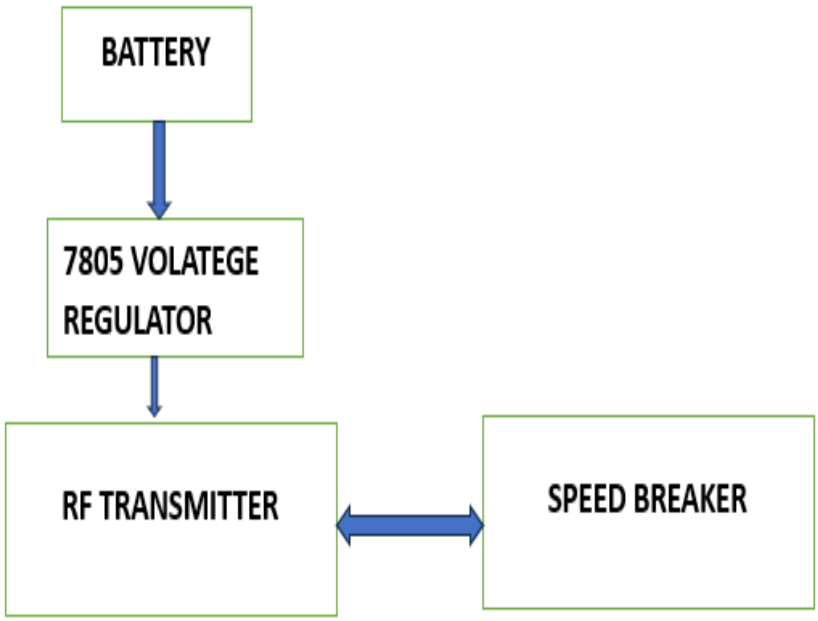


Fig.3.1: Block Diagram of Speed Breaker Section

3.1.2: Smart Robot Section

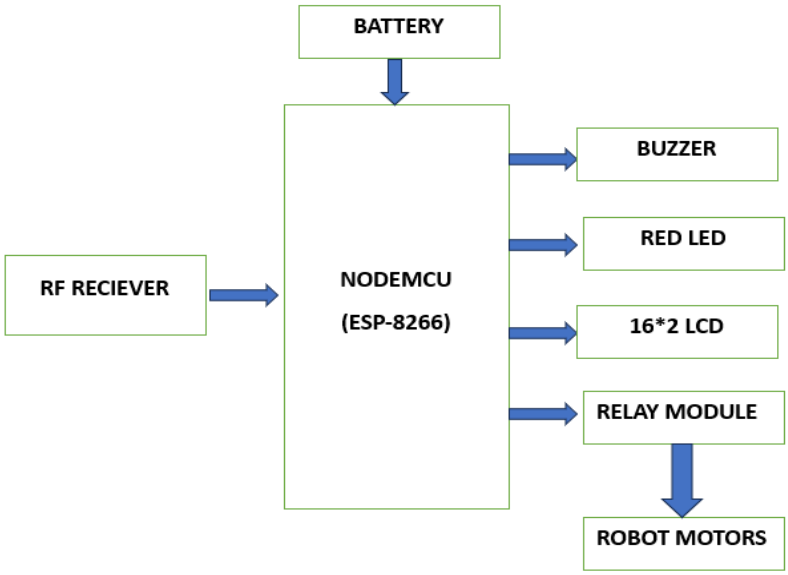


Fig.3.2: Block Diagram of Smart Robot Section

In our project it is equipped with rf rx/tx modules. At speed breaker side rf transmitter is placed for transmuting the signals to vehicles for indicating that there is a speed breaker Infront of vehicle. If speed breaker is detected then immediately it will send the data to vehicle if driver slow vehicle ok otherwise automatically it will slowdown the vehicle using NodeMCU and relay module.

3.2: Working

In our project it is equipped with rf rx/tx modules. At speed breaker side rf transmitter is placed for transmuting the signals to vehicles for indicating that there is a speed breaker Infront of vehicle. If speed breaker is detected then immediately it will send the data to vehicle if driver slow vehicle ok otherwise automatically it will slowdown the vehicle using nodemcu and relay module.

3.3: Advantages

-
- Preventing the accidents at Danger Zones
- High Safety
- Low maintenance cost
- Works in both Manual and Automatic Mode

3.4: Applications

- Used is smart vehicle
- Used at speed breakers on Highways to alert high-speed moving vehicles
- We can implement this system at School zones, Hospital Areas and Public moving areas

CHAPTER 4
HARDWARE & SOFTWARE COMPONENTS

4.1: Hardware Components

4.1.1: RF Transceivers

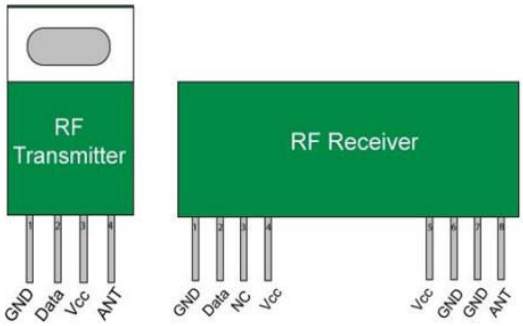


Fig.4.1: RF Transceiver

Generally, an RF module is a small size electronic device that is used to transmit or receive radio signals between two devices. The main application of RF module is an embedded system to communicate with another device wirelessly. This communication may be accomplished through radio frequency communication. For various applications the medium of choice is radio frequency since it does not need line of sight. The applications of RF modules mainly involve in low volume and medium volume products for consumer applications like wireless alarm systems, garage door openers, smart sensor applications, wireless home automation systems and industrial remote controls.

A transceiver is a blend of a transmitter and a receiver in a single package. The name applies to wireless communication devices like cellular telephones, handheld two-way radios, cordless telephone sets, and mobile two-way radios. Sometimes the term is used in reference to the transmitter or receiver devices in optical fiber systems or cables.

Fig.4.2: RF Transceiver Module

In a radio transceiver, the receiver is silenced while transmitting. An electronic switch permits the transmitter and receiver to be allied to the same antenna and stops the o/p of the transmitter from injuring the receiver. With this kind of a transceiver, it is difficult to get signals while transmitting and this mode is named as half duplex.

Some kind of transceivers is designed to let reception of signals through transmission periods. This mode is called as full duplex, and needs that the transmitter (TX) and receiver (RX) work on considerably different frequencies so the signal which is transmitted doesn't interfere with reception. Communication devices sets use this mode. Satellite communication networks frequently employ full-duplex transceivers at the surface-based subscriber points. The transceiver-to-satellite (transmitted) signal is called the uplink, and the satellite-to-transceiver (received) signal is called the downlink.

Block Diagram of RF Transceivers

In general, the designer of wireless systems has two overriding limitations: it must work over a convinced distance and transfer a convinced amount of information within a data rate. The size of the RF modules is very small and have an extensive range of a operating voltage that is 3V to 12V.

Basically, these modules are 433 MHz RF TX and RX modules. The transmitter (TX) draws no power when transferring logic zero while fully destroying the carrier frequency, thus consume considerable low power in battery operation. When logic1 is sent carrier is fully on to about 4.5mA with a 3V power supply.

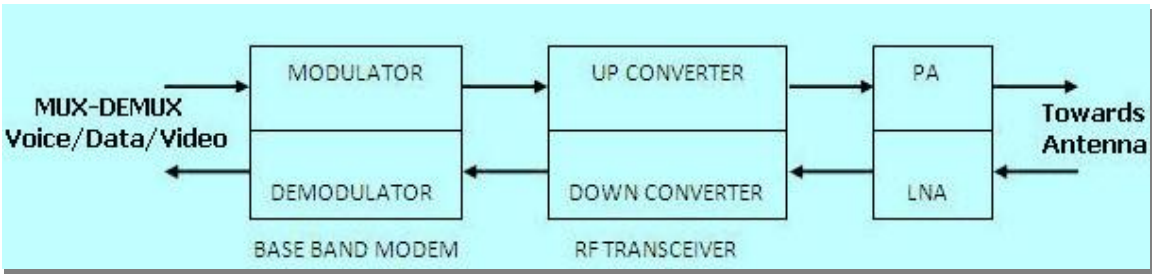


Fig4.3: RF Transceiver Block Diagram

RF modules can be applied for various types, sizes and shapes of electronic circuit boards. It can also be useful for modules across a vast variety of capacity and functionality. These modules typically include a PCB, TX circuit or RX circuit,

antenna and serial interface for communication to the main processor. The types of RF modules mainly include RF transmitter module, RF receiver module RF transceiver module and SOC module. There are 3-types of signal modulation techniques commonly used in RF transmitter and RF receiver modules such as ASK-amplitude shift keying, OOK-On-Off Keying and FSK-frequency shift keying. An RF transceiver module includes both a transmitter and receiver.

RF Transmitter

An RF transmitter module is a small size PCB capable of transferring a radio wave and modulating radio wave to carry data. RF transmitter modules are usually applied along with a micro controller, which will offer data to the module which can be transmitted. These transmitters are usually subject to controlling requirements which command the maximum acceptable transmitter power o/p, band edge and harmonics requirements.

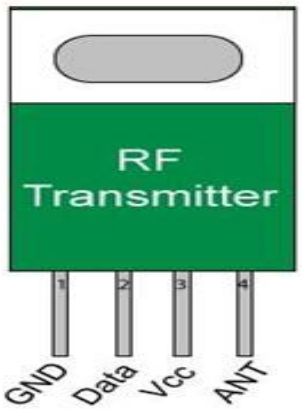


Fig4.4: RF Transmitter

Table 4.1: RF Transmitter Pin Description:

Pin No	Function	Name
1	Ground (0V)	Ground
2	Serial data input pin	Data
3	Supply voltage; 5V	Vcc
4	Antenna output pin	ANT

4.1.2: RF Receiver

An RF receiver module takes the modulated RF signal to demodulate it. There are two kinds of RF receiver modules, namely the super-regenerative receivers and super-heterodyne receivers. Usually, super-regenerative modules are low power designs and low cost using a series of amplifiers to remove modulated data from a carrier wave. These modules vary, generally inaccurate as their operation of frequency significantly with power supply voltage and temperature. The main advantage of Super heterodyne receiver modules is a high performance over super-regenerative. They offer increased stability and accuracy over a large temperature and voltage range. This stability comes from a stable crystal design which in turn leads to a relatively more expensive product.

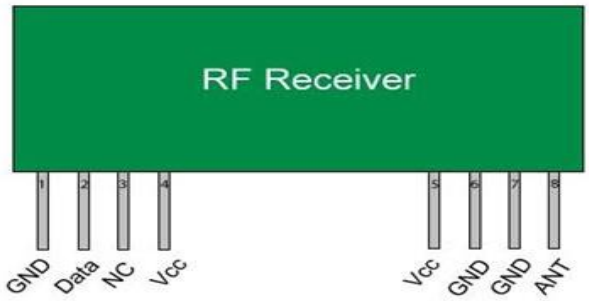


Fig4.5: RF Receiver

Table 4.2: RF Receiver Pin Description:

Pin No	Function	Name
1	Ground (0V)	Ground
2	Serial data output pin	Data
3	Linear output pin; not connected	NC
4	Supply voltage; 5V	Vcc
5	Supply voltage; 5V	Vcc
6	Ground (0V)	Ground
7	Ground (0V)	Ground
8	Antenna input pin	ANT

4.1.3: Voltage Regulator

The function of the voltage regulator is to control the voltage given to the Arduino board and stabilize the DC voltages used by the processor and other elements. A voltage regulator is designed to automatically maintain a constant voltage level. A voltage regulator may be a simple "feed-forward" design or may include negative feedback control loops. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages. Electronic voltage regulators are found in devices such as computer power supplies where they stabilize the DC voltages used by the processor and other elements. In automobile alternators and central power station generator plants, voltage regulators control the output of the plant. In an electric power distribution system, voltage regulators may be installed at a substation or along distribution lines so that all customers receive steady voltage independent of how much power is drawn from the line.

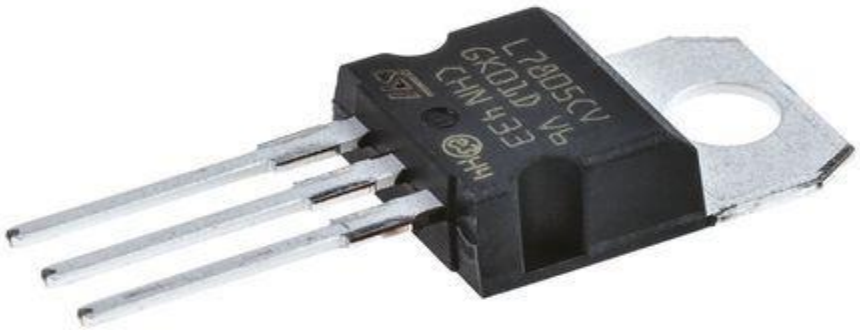


Fig.4.6: Voltage Regulator

4.1.4: Battery

Hi-Waote 9V Battery is the most commonly used and portable 9V battery. It is non-rechargeable and is a high capacity and low-cost solution for many electronic devices. It is based on Zinc Carbon Chemistry and can be used easily replaced if discharged just like any standard AA and AAA batteries.

Fig.4.7: Battery

4.1.5: ESP-12E Wi-Fi Module (esp8266)

ESP-12E Wi-Fi module is developed by Ai-thinker Team. core processor ESP8266 in smaller sizes of the module encapsulates Tensilica L106 integrates industry-leading ultra-low power 32-bit MCU micro, with the 16-bit short mode, Clock speed support 80 MHz, 160 MHz, supports the RTOS, integrated Wi-Fi MAC/BB/RF/PA/LNA, on-board antenna. The module supports standard IEEE802.11 b/g/n agreement, complete TCP/IP protocol stack. Users can use the add modules to an existing device networking, or building a separate network controller. ESP8266 is high integration wireless SOCs, designed for space and power constrained mobile platform designers. It provides unsurpassed ability to embed Wi-Fi capabilities within other systems, or to function as a standalone application, with the lowest cost, and minimal space requirement.

ESP8266EX offers a complete and self-contained Wi-Fi networking solution; it can be used to host the application or to offload Wi-Fi networking functions from another application processor. When ESP8266EX hosts the application, it boots up directly from an external flash. ESP8266EX is among the most integrated Wi-Fi chip in the industry; it integrates the antenna switches, RF balun, power amplifier, low noise receive amplifier, filters, power management modules, it requires minimal external circuitry, and the entire solution, including front-end module, is designed to occupy minimal PCB area.

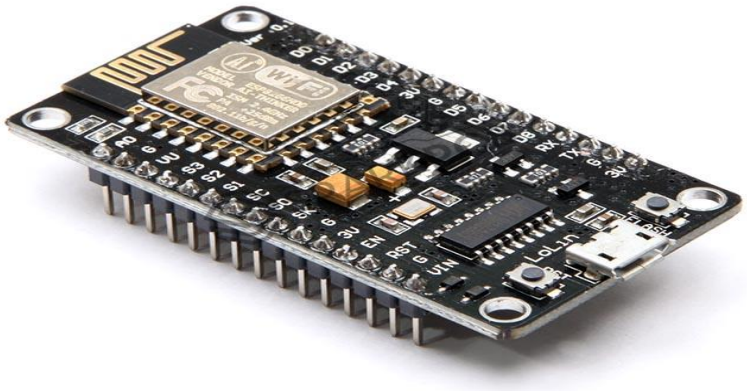


Fig.4.8: ESP8266-12E

The **ESP8266** has seen a wide adoption as a cost-effective solution for IOT and Wi-Fi-capable devices. The **ESP8266** was developed by Shangai-based Espressif systems, as a Serial (UART) to Wi-Fi SoC (System on a Chip) based around a Tensilica Xtensa LX3DPU. This tiny IC includes an RF front end, RAM, and (usually) an onboard TCP/IP stack that allows it ready to connect to a nearby Access Point, to act as an Access Point itself, or both.

Family of Breakout Boards (ESP-NN):

Quickly after launch, a variety of breakout boards for the **ESP8266** started becoming available. The most popular ones have been the **ESP-NN** series, which typically integrate the SOC along with Flash RAM, a crystal, and even an onboard antenna. The most salient distinction between different **ESP-NN** models are the pins that are broken out from the **ESP8266**

As the **ESP8266** was developed as a Serial to Wi-Fi adapter, its firmware implemented an interpreter for AT commands. Thus, initial usage of the IC was limited to using a either a USB to Serial adapter, or a separate microcontroller (e.g., **ATmega328**) to issue AT commands over the **ESP8266**'s Serial UART interface. For this reason, the **ESP-01** board quickly became popular amongst the **ESP8266 c**ommunity because of its 2×4, 0.1in-pitch connector that can be easily wired to a USB to Serial adapter.

Features:

• 802.11 b/g/n

• Integrated low power 32-bit MCU

•Integrated 10-bit ADC

• Integrated TCP/IP protocol stack

• Integrated TR switch, balun, LNA, power amplifier and matching network

• Integrated PLL, regulators, and power management units

• Supports antenna diversity

• Wi-Fi 2.4 GHz, support WPA/WPA2

• Support STA/AP/STA+AP operation modes

• Support Smart Link Function for both Android and IOS devices

• Support Smart Link Function for both Android and iOS devices

• SDIO 2.0, (H) SPI, UART, I2C, I2S, IRDA, PWM, GPIO

• STBC, 1x1 MIMO, 2x1 MIMO

• A-MPDU & A-MSDU aggregation and 0.4s guard interval Shenzhen Anxinke Technology

Applications:

- Smart power plugs
- Home automation
- Mesh network
- Industrial wireless control
- Baby monitors
- IP Cameras

A few different firmware options are available for the ESP8266. These allow us to access the module in different ways, as you can see below. Whereas the AT commands are the standard way of communicating with wireless-capable ICs (e.g., Bluetooth, Wi-Fi, GSM), they pose the limitation of needing another module to run the application that specifies these commands accordingly. However, if we could run the application within the **ESP8266** itself then we'd have everything self-contained by a single IC. Fortunately, Espressif made a Software Development Kit (SDK) available that allowed users to flash different firmware options.

Table 4.3: AT Commands:

Command	Description
AT	Test AT start up
AT+RST	Restart module
AT+GMR	View version Info
AT+GSLP	Enter deep sleep mode
ATE	AT commands echo or not
AT+RESTORE	Factory Reset
AT+UART	UART Configuration
AT+UART_CUR	UART current configuration
AT+UART_DEF	UART default configuration, save to flash
AT+SLEEP	Sleep mode
AT+RFPOWER	Set maximum value of RF TX power
AT+RFVVD	RF TX power according to VDD33

AT Command Processor (Default):

The quickest way to get started with the **ESP8266** is to use its original firmware, which allows it to process any AT commands that it receives over its Serial UART interface. The biggest advantage of this option is that we need not be familiar with any specific language or framework to use the module. We can simply send it a series of commands to achieve our goal. The downside to this is that we need either an additional microcontroller involved or a USB to Serial adapter to send the necessary commands.

Whereas the AT commands are the standard way of communicating with wireless-capable ICs (e.g., Bluetooth, Wi-Fi, GSM), they pose the limitation of needing another module to run the application that specifies these commands accordingly. However, if we could run the application within the **ESP8266** itself then we'd have everything self-contained by a single IC. Fortunately, Espressif made a Software Development Kit (SDK) available that allowed users to flash different firmware options.

ESP-12E Pin design:

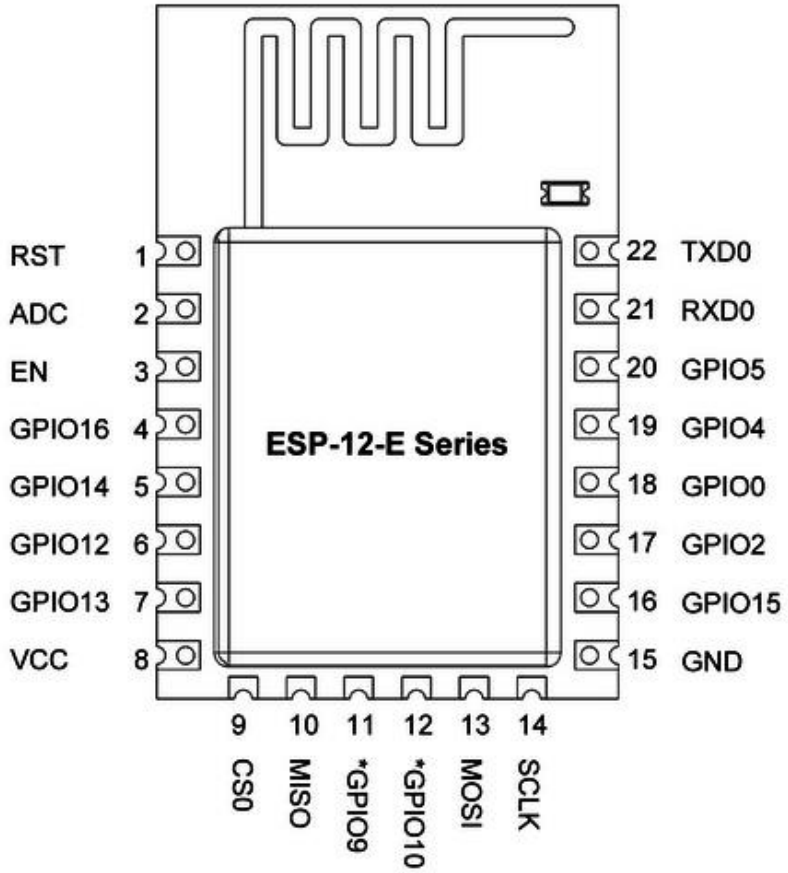


Fig.4.9: Pin Diagram of ESP-12

Table 4.4: Pin Details & Function of ESP-12E

NO.	Pin Name	Function
1	RST	Reset the module
2	ADC	A/D Conversion result. Input voltage range 0-1v,scope:0-1024
3	EN	Chip enable pin. Active high
4	IO16	GPIO16; can be used to wake up the chipset from deep sleep mode.
5	IO14	GPIO14; HSPI_CLK
6	IO12	GPIO12; HSPI_MISO
7	IO13	GPIO13; HSPI_MOSI; UART0_CTS
8	VCC	3.3V power supply (VDD)
9	CS0	Chip selection
10	MISO	Salve output Main input
11	IO9	GPIO9
12	IO10	GBIO10
13	MOSI	Main output slave input
14	SCLK	Clock
15	GND	GND

16	IO15	GPIO15; MTDO; HSPICS; UART0_RTS
17	IO2	GPIO2; UART1_TXD
18	IO0	GPIO0
19	IO4	GPIO4
20	IO5	GPIO5
21	RXD	UART0_RXD; GPIO3
22	TXD	UART0_TXD; GPIO1

Table 4.5: Pin mode

Mode	GPIO15	GPIO0	GPIO2
UART	Low	Low	High
Flash Boot	Low	High	High

Table 4.6: Dimension of ESP-12E Wi-Fi Module

Length	Width	Height	PAD Size (Bottom)	Pin Pitch
16 mm	24mm	3 mm	0.9 mm x 1.7 mm	2mm

Functional Descriptions:

MCU:

ESP8266EX is embedded with Tensilica L106 32-bit micro controller (MCU), which features extra low power consumption and 16-bit RSIC. The CPU clock speed is 80MHz. It can also reach a maximum value of 160MHz. ESP8266EX is often integrated with external sensors and other specific devices through its GPIOs; codes for such applications are provided in examples in the SDK.

Memory Organization:

Internal SRAM and ROM:

ESP8266EX Wi-Fi SOC is embedded with memory controller, including SRAM and ROM. MCU can visit the memory units through iBus, dBus, and AHB interfaces. All memory units can be visited upon request, while a memory arbiter will decide the running sequence according to the time when these requests are received by

the processor. According to our current version of SDK provided, SRAM space that is available to users is assigned as below:

▪ RAM size < 36kB, that is to say, when ESP8266EX is working under the station mode and is connected to the router, programmable space accessible to user in heap and data section is around 36kB.)

▪ There is no programmable ROM in the SOC, therefore, user program must be stored in an external SPI flash.

External SPI Flash:

This module is mounted with a 4 MB external SPI flash to store user programs. If larger definable storage space is required, a SPI flash with larger memory size is preferred. Theoretically speaking, up to 16 MB memory capacity can be supported.

4.1.6: LCD (Liquid Crystal Display)

A liquid crystal display or LCD draws its definition from its name itself. It is combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. Liquid crystal displays are super-thin technology display screen that are generally used in laptop computer screen, TVs, cell phones and portable video games. LCD's technologies allow displays to be much thinner when compared to cathode ray tube (CRT) technology.

Liquid crystal display is composed of several layers which include two polarized panel filters and electrodes. LCD technology is used for displaying the image in notebook or some other electronic devices like mini computers. Light is projected from a lens on a layer of liquid crystal. This combination of colored light with the grayscale image of the crystal (formed as electric current flows through the crystal) forms the colored image. This image is then displayed on the screen.

An LCD is either made up of an active-matrix display grid or a passive display grid. Most of the Smartphone's with LCD display technology uses active-matrix display, but some of the older displays still make use of the passive display grid designs. Most of the electronic devices mainly depend on liquid crystal display

technology for their display. The liquid has a unique advantage of having low power consumption than the LED or cathode ray tube.

Liquid crystal display screen works on the principle of blocking light rather than emitting light. LCD's requires backlight as they do not emit light by them. We always use devices which are made up of LCD's displays which are replacing the use of cathode ray tube. Cathode ray tube draws more power compared to LCD's and are also heavier and bigger.

LCD Pin Description:

Probably this very post should have come before the number of other posts related to 8051 LCD interfacing, but its never too late. This post will describe you about the pins of LCD normally available in the market. It looks almost like the one shown below. As you guys can see that there are 8 data pins along with 3 control pins. One ground and two power pins are also there. Lets study about these pins of LCD.

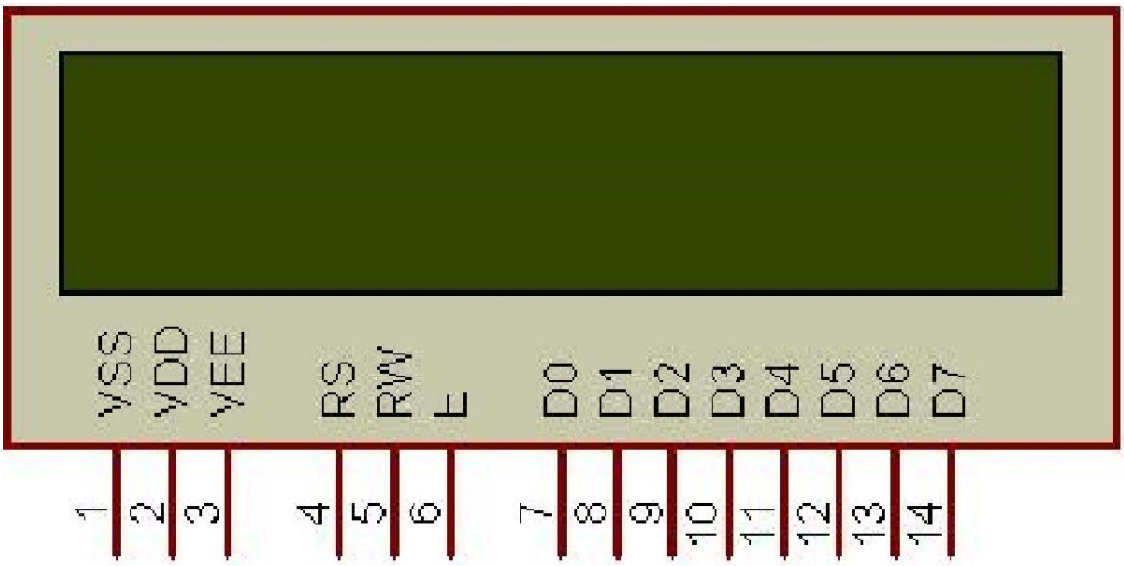


Fig.4.10 : LCD Pin Diagram

Table 4.7: LCD Pin Discription

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

VSS, VDD and VEE:

Pin 1 (VSS) is a ground pin and it is certainly needed that this pin should be grounded for LCD to work properly. VEE and VDD are given +5 volts normally. However, VEE may have a potentiometer voltage divider network to get the contrast adjusted. But VDD is always at +5V.

RS, R/W and E:

These three pins are numbered 4, 5 and 6 as shown above. RS is used to make the selection between data and command register. For RS=0, command registers selected and for RS=1 data register is selected.

R/W gives you the choice between writing and reading. If set (R/W=1) reading is enabled. R/W=0 when writing.

Enable pins is used by the LCD to latch information presented to its data pins. When data is supplied to data pins, a high to low pulse must be applied to this pin in-order for the LCD to latch in the data present at the data pins. It may be noted here that the pulse must be of minimum 450ns wide.

D0-D7:

The 8-bit data pins, D0-D7, are used to send information to the LCD or read the contents of LCD's internal register.

"To display letters and numbers, we send ASCII code for the letters A-Z, a-z and numbers 0-9 while making RS=1. We also use RS=0 to check the busy flag bit to see if the LCD is ready to receive information. The busy flag is D-7 and can be read when R/W=1 and RS=0, as follows: if R/W=1, RS=0. When D7=1 (busy flag=1), the LCD is busy taking care of internal operations and will not accept any new information. When D7=0, the LCD is ready to receive new information. It is recommended to check the busy flag before writing any data to LCD".

Advantages of an LCD's:

- LCD's consumes less amount of power compared to CRT and LED
- LCD's are consist of some microwatts for display in comparison to some milli watts for LED's
- LCDs are of low cost
- Provides excellent contrast
- LCDs are thinner and lighter when compared to cathode ray tube and LED

Disadvantages of an LCD's:

- Require additional light sources
- Range of temperature is limited for operation
- Low reliability
- Speed is very low
- LCD's need an AC drive

Applications of Liquid Crystal Display:

Liquid crystal technology has major applications in the field of science and engineering as well on electronic devices.

- Liquid crystal thermometer
- Optical imaging
- The liquid crystal display technique is also applicable in visualization of the radio frequency waves in the waveguide
- Used in the medical application

4.1.7: BUZZER

Electromechanical

The electric buzzer was invented in 1831 by Joseph Henry. They were mainly used in early doorbells until they were phased out in the early 1930s in favor of musical chimes, which had a softer tone.

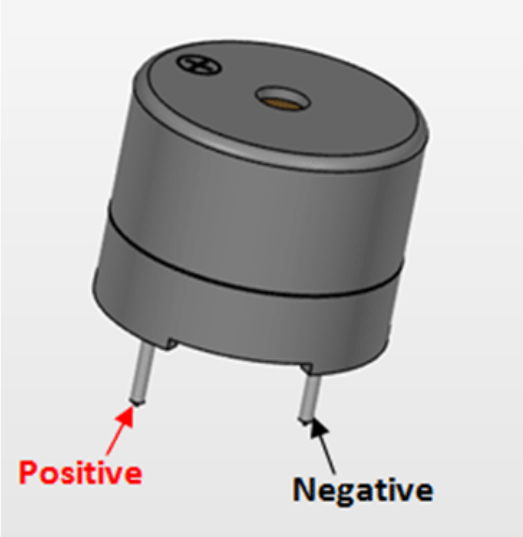


Fig.4.11 : Buzzer

Piezoelectric

Piezoelectric buzzers, or piezo buzzers, as they are sometimes called, were invented by Japanese manufacturers and fitted into a wide array of products during the 1970s to 1980s. This advancement mainly came about because of cooperative efforts by Japanese manufacturing companies. In 1951, they established the Barium Titanate Application Research Committee, which allowed the companies to be "competitively cooperative" and bring about several piezoelectric innovations and inventions.

Electromechanical

Early devices were based on an electromechanical system identical to an electric bell without the metal gong. Similarly, a relay may be connected to interrupt its own actuating current, causing the contacts to buzz. Often these units were anchored to a wall or ceiling to use it as a sounding board. The word "buzzer" comes from the rasping noise that electromechanical buzzers made.

Mechanical

A joy buzzer is an example of a purely mechanical buzzer and they require drivers. Other examples of them are doorbells.

4.1.8: DC Gear Motors

Almost every mechanical development that we see around us is accomplished by an electric motor. Electric machines are a method of converting energy. Motors take electrical energy and produce mechanical energy. Electric motors are utilized to power hundreds of devices we use in everyday life.

Electric motors are broadly classified into two different categories: Direct Current (DC) motor and Alternating Current (AC) motor. In this article we are going to discuss about the DC motor and it's working. And also, how a gear DC motors works.

A DC motor is an electric motor that runs on direct current power. In any electric motor, operation is dependent upon simple electromagnetism. A current carrying conductor generates a magnetic field, when this is then placed in an external magnetic field, it will encounter a force proportional to the current in the conductor and to the strength of the external magnetic field. It is a device which converts electrical energy to mechanical energy. It works on the fact that a current carrying conductor placed in a magnetic field experiences a force which causes it to rotate with respect to its original position.

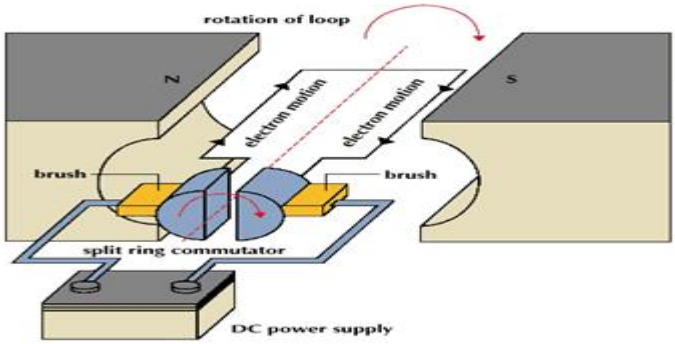


Fig.4.12: Brushless DC motors working

The input of a brushless DC motor is current/voltage and its output is torque. Understanding the operation of DC motor is very simple from a basic diagram is shown in below. DC motor basically consist two main parts. The rotating part is called

the rotor and the stationary part is also called the stator. The rotor rotates with respect to the stator.

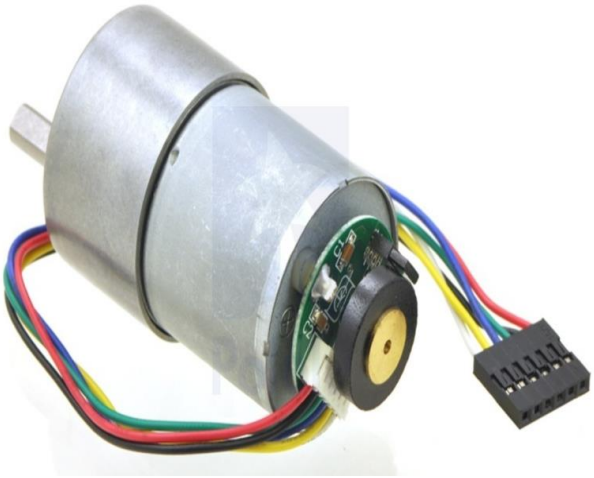


Fig.4.13: DC geared Motor

The rotor consists of windings, the windings being electrically associated with the commutator. The geometry of the brushes, commutator contacts and rotor windings are such that when power is applied, the polarities of the energized winding and the stator magnets are misaligned and the rotor will turn until it is very nearly straightened with the stator's field magnets.

As the rotor reaches alignment, the brushes move to the next commutator contacts and energize the next winding. The rotation reverses the direction of current through the rotor winding, prompting a flip of the rotor's magnetic field, driving it to keep rotating.

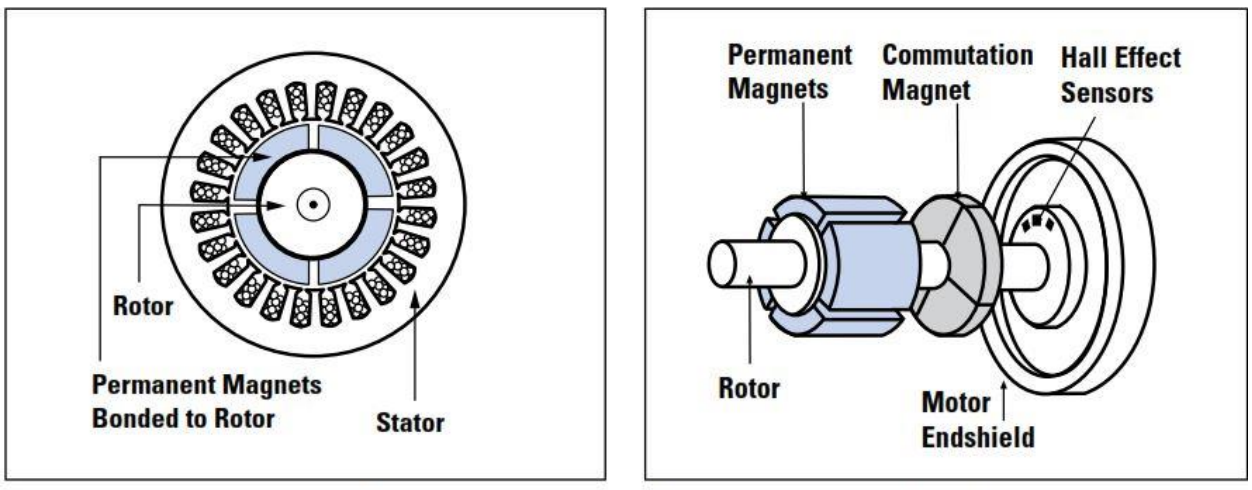


Fig.4.14 : a.Cross-Section of a brushless DC motor

b.Components of a brushless DC motor Commutator

Advantages of DC Motor:

1. Provide excellent speed control for acceleration and deceleration
2. Easy to understand design
3. Simple, cheap drive design

DC Motor Equations:

Magnitude of flux experienced is

F=BIL **…4.1**

Where, B- Flux density due to flux produced by field windings

l- Active length of the conductor

I-Current passing through the conductor

As the conductor rotates, an EMF is induced which acts in a direction opposite to the supplied voltage. It is given as

$$E_b = \frac{\emptyset PNZ}{60A} \quad \textbf{…4.2}$$

Where, Ø - Flux due to the field windings

P- Number of poles

A-A constant

N – Speed of the motor

Z- Number of conductors

The supply voltage, $V = E_b + I_aR_a$

The torque developed is

$$Ta = \frac{0.159\emptyset IaPZ}{A} \quad \textbf{…4.3}$$

- Changing flux by controlling the current through field winding- Flux Control method. By this method, speed is controlled above its rated speed.
- Armature Voltage Control – Provides speed control below its normal speed.
- Supply Voltage Control – Provides speed control in both directions.

4 Quadrant Operation of DC Motor:

Generally, a motor can operate in 4 different regions:

- As a motor in forward or clockwise direction.
- As a generator in forward direction.
- As a motor in reverse or anticlockwise direction.
- As a generator in reverse direction.

Application to Control DC Motor Operation in 4 Quadrants:

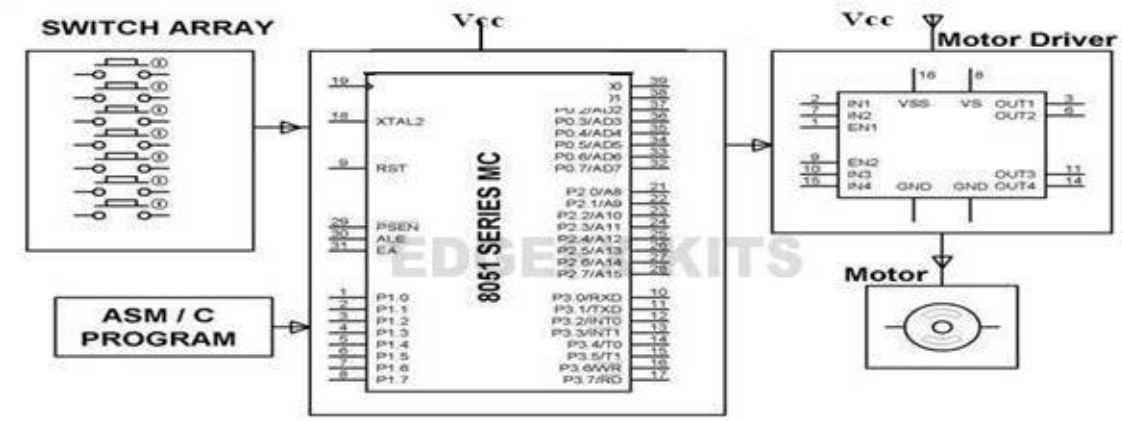


Fig.4.15: Application to Control DC Motor Operation in 4 Quadrants:

Control of DC motor operation in 4 quadrants can be achieved using a Microcontroller interfaced to 7 switches.

Case1: When start and clockwise switch is pressed, the logic in Microcontroller gives a output of logic low to pin 7 and logic high to pin2, making the motor rotate in clockwise direction and operate in 1st quadrant. The speed of the motor can be varied by pressing the pwm switch, causing a application of pulses of varying duration to the enable pin of the driver IC, thus varying the applied voltage.

Case 2: When forward brake is pressed, Microcontroller logic applies logic low to pin7 and logic high to pin 2 and the motor tends to operate in its reverse direction, causing it to stop instantly.

Types of DC Motors:

Geared DC Motors:

Geared motors tend to reduce the speed of the motor but with a corresponding increase in torque. This property comes in handy, as DC motors can rotate at speeds much too fast for an electronic device to makes use of. Geared motors commonly consist of a DC brush motor and a gearbox attached to the shaft. Motors are distinguished as a geared by two connected units. It has many applications due to its cost of designing, reduces the complexity and constructing applications such as industrial equipment, actuators, medical tools and robotics.

- No good robot can ever be built without gears. All things considered, a good understanding of how gears affect parameters such as torque and velocity are very important.

Fig.4.16: Geared DC Motor

A **gear motor** is a specific type of electrical motor that is designed to produce high torque while maintaining a low horsepower, or low speed, motor output. Gear motors can be found in many different applications, and are probably used in many devices in your home.

Basic Principles of Operation:

A gear motor can be either an AC (alternating current) or a DC (direct current) electric motor. Most gear motors have an output of between about 1,200 to 3,600 revolutions per minute (RPMs). These types of motors also havewo different speed specifications: normal speed and the stall-speed torque specifications.

An excellent example of this principle would be an electric time clock (the type that uses hour, minute and second hands). The synchronous AC motor that is used to power the time clock will usually spin the rotor at around 1500 revolutions per minute. However, a series of reduction gears is used to slow the movement of the hands on the clock.

Gear Motors and Increased Force:

Gear motors are commonly used in commercial applications where a piece of equipment needs to be able to exert a high amount of force in order to move a very heavy object. Examples of these types of equipment would include a crane or lift Jack.

If you've ever seen a crane in action, you've seen a great example of how a gear motor works. As you have probably noticed, a crane can be used to lift and move very heavy objects. The electric motor used in most cranes is a type of gear motor that uses the basic principles of speed reduction to increase torque or force.

Speed Reduction in Geared DC Motor:

Speed reduction in gears comprises of a little gear driving a larger gear. There may be few sets of these reduction gear sets in a reduction gear box. Sometimes the objective of using a gear motor is to reduce the rotating shaft speed of a motor in the device being driven, for example in a small electric clock where the tiny synchronous motor may be turning at 1,200 rpm however is decreased to one rpm to drive the second hand and further reduced in the clock mechanism to drive the minute and hour hands. Here the amount of driving force is irrelevant as long as it is sufficient to overcome the frictional impacts of the clock mechanism.

Applications:

DC motors are suitable for many applications – including conveyors, turntables and others for which adjustable speed and constant or low-speed torque are required. They also work well in dynamic braking and reversing applications, which are common in many industrial machines.

Their quick acceleration, stopping and reversing – along with their linear-speed torque curve – make the DC motor a popular choice in many new designs, particularly for fractional hp applications.

4.1.9: Robotic Chassis

Chassis is a framework which supports the body of a robot. It is a vehicle frame on which one can install the body of the robot. We are here to help you find innovative and efficient chassis for your robotic system. Get robotic chassis and parts to build your own robotic systems with ease. Build robotic projects and mechanics using our robotic chassis. Innovative and efficient chassis with designs that help you build your own mechanisms using our chassis. Develop custom robotics using our chassis and robotic parts. From Walking to vehicle robots, we have all the robotic parts you need. From robot vehicle and tank chassis to 6dof arms, we have all the parts you need to design your efficient robots. Browse through our category of 3-10 dof robotic chassis and parts for robotics development today. You can build your own walking robot to a rough terrain vehicle with all the required parts available with us. Develop custom robotics using our chassis and robotic parts.

Platforms:

Wheeled Platforms:

Wheeled platforms can have any number of wheels. Most common are 3, 4 and 6 wheeled vehicles (excluding wheels used for feedback). Other numbers are also possible, but can be hard to build, such as 1-wheeled or 2-wheeled robots, or have superfluous wheels which can make turning difficult or complex. Basically there are 2 types of wheels: powered wheels and unpowered wheels. The first are powered by the motors and are used to move the robot forwards (or backwards). Unpowered wheels are used to keep the robot in balance by providing a point of contact with the ground.

Turning:

Turning can be accomplished in several different ways:

- Differential Steering (Tank-like Turning):

- Moves one wheel forward and the other backwards. The robot turns around within a small circle which center lies in between the 2 powered wheels.

- Move one wheel slower than the other, the robot turns in the direction of the slower wheel. How fast it turns depends on how large the difference between the 2 speeds is.

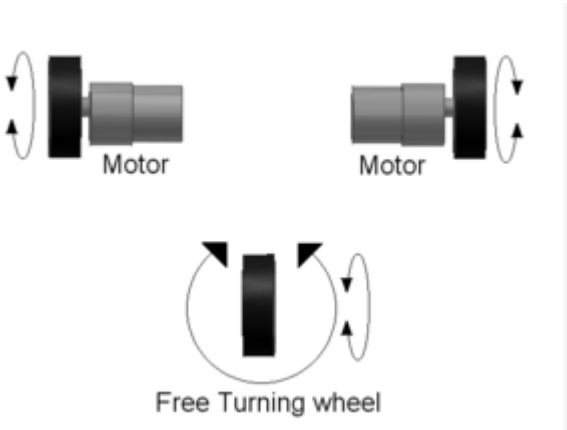


Fig.4.17: Motor and wheels

- **Ackerman Steering**: This is the same steering system as the one used in cars. It is relatively complicated to implement since the inner and outer wheels need to turn to different angles.

- **Crab Drive:** Each wheel can turn independently in crab drive steering. This can be very flexible, but requires complex mechanics which either turn the entire motor/gearbox/wheel assembly or transfer power from a statically mounted motor. The second option is much more difficult to build but may have advantages over the first.

- **3-wheeled platforms:** These can come in a variety of forms, with the articulated wheel powered, or with the two fixed wheels powered, or a combination of the two. These are generally built for very specific purposes.

- **Omni directional wheels:** The omnidirectional wheels design is based upon the use of a series of free turning barrel-shaped rollers, which are mounted in a staggered pattern around the periphery of a larger diameter main wheel. For this you need 4 powered wheels. However, these wheels allow movement in any direction without turning (including sideways and diagonal movement) and can turn the same way as in tank like steering. Building these wheels is time-consuming, but it's a very powerful steering method. Also, inexpensive omnidirectional wheels are available commercially, often used in conveyors. One drawback, however, is the lack of sideways traction; if something is pushing the robot to the side, it relies on the strength of the motor or brakes to restrain it. Omni directional wheels used in place of caster wheels can provide quicker responses and can often roll over larger obstacles.

Parts of the Robot Chassis:

- Caster wheel: This swivels around to allow robot movement in any direction. When you assemble this later make sure you use the 4 screws with large heads. (see photo)
- Encoder discs (2) Not Used in this kit. These can be used with more complex software to measure the wheel rotation.
- 3mm (Millimeters) size 30mm long machine screw (4) use to assemble to motors and brackets.
- Power Switch (optional): This may be difficult to push into place in the rectangular cutout in the chassis. Wiring details later.
- Motor Mounting Brackets (4) will hold the motors to the chassis.
- Assorted 3mm diameter machine screws and nuts.
- 12mm long brass metal standoffs (4). These are threaded inside so screws can be used to hold the Caster Wheel in place at the right level

Robot chassis and wheels:

1. Robot chassis: Laser-cut clear plastic. NOTE: This has a stick-on paper covering, and this is a good time to remove it if you want the clear plastic to be shown.

2. Wheels (2). NOTE: The wheels have a hole with two flat sections. Make sure you line this up with the motor shafts later when you attach them.

3. DC Gear Reduction Motor (2). Note these have 2 wires attached. Later when you assemble them to the chassis, make sure the wires go toward the center of the robot.

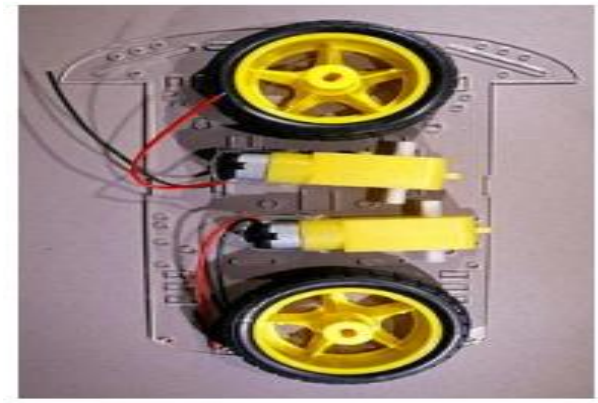


Fig.4.18.: Robot chassis and wheels

Assembling the Robot base chassis and attaching the parts:

You will attach these parts to the robot chassis and then connect them electrically:

- Motor Driver Board
- Drive Motors
- Ultrasonic Distance Sensor
- Servomotor
- Battery Case

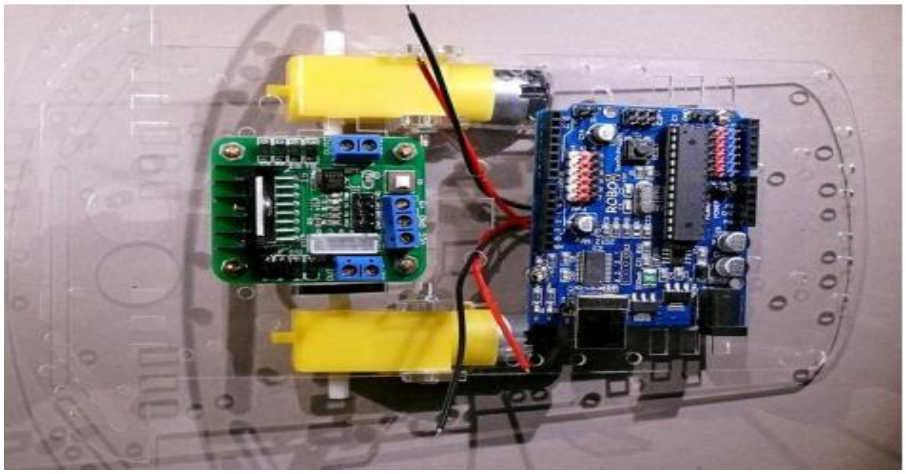


Fig.4.19: Assembling the Robot base chassis and attaching the parts

Assembly:

Chassis: If you plan to use the power switch, line it up with the rectangular hole in the center of the chassis and PUSH it down into position. This may take a strong person with strong fingers! NOTE: The switch has a red dot showing the ON position. We suggest you point it toward the front (wide end) of the robot

Motor Driver Board: Attach the Motor Driver Board to the chassis using 4 of the shorter 3mm machine screws. (See photo for location of the holes. Orient the black heat sink toward the front.)

Motors: Locate the 4 Motor Mounting Brackets. Use 2 at a time to assemble the motors to the chassis.

• A bracket is inserted in the center slot and a second bracket goes in a slot on the outer edge of the chassis.

• Turn the chassis over; insert long machine screws through the outer brackets, the motor, and the inner bracket.

• Attach two nuts and tighten snugly but not real tight.

• Install the second motor on the other side.

• NOTE: Make sure the wires go towards the center of the robot

Caster wheel:

• Place the caster wheel on the bottom of the chassis to see which 4 holes line up with it.

• Now, attach the 4 metal 'standoffs' by putting 10mm long machine screws from the top of the chassis, through the 4 holes and into one end of the standoffs. Hold the standoffs and tighten the screws with a small Phillips screwdriver.

• Line the caster wheel holes up with the 4 standoffs and attach it with the 4 small screws that have large flat heads. We suggest you wait until later to attach the wheels. It's easier to test the wiring and software when the robot can't try to escape

4.1.10: RELAY

Introduction:

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit.

Basic design and operation:

A simple electromagnetic relay consists of a coil of wire wrapped around a soft iron core (a solenoid), an iron yoke which provides a low reluctance path for magnetic flux, a movable iron armature, and one or more sets of contacts (there are two contacts

in the relay pictured). The armature is hinged to the yoke and mechanically linked to one or more sets of moving contacts. The armature is held in place by a spring so that when the relay is de-energized there is an air gap in the magnetic circuit. In this condition, one of the two sets of contacts in the relay pictured is closed, and the other set is open. Other relays may have more or fewer sets of contacts depending on their function. The relay in the picture also has a wire connecting the armature to the yoke. This ensures continuity of the circuit between the moving contacts on the armature, and the circuit track on the printed circuit board (PCB) via the yoke, which is soldered to the PCB.

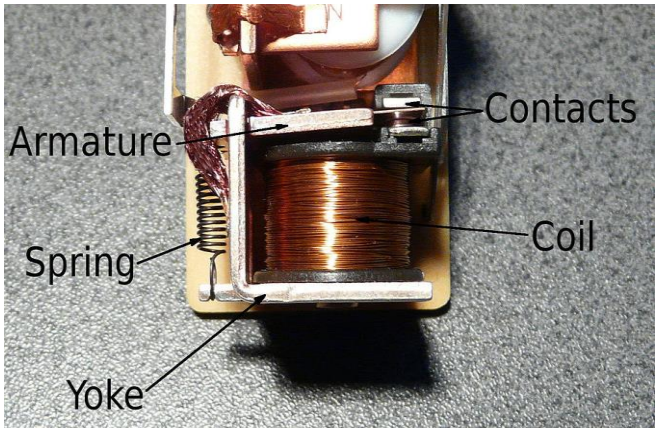


Fig.4.20: Simple electromechanics

VCC and RY-VCC are also the power supply of the relay module. When you need to drive a large power load, you can take the jumper cap off and connect an extra power to RY-VCC to supply the relay; connect VCC to 5V of the MCU board to supply input signals. NOTES: If you want complete optical isolation, connect "Vcc" to Arduino +5 volts but do NOT connect Arduino Ground. Remove the Vcc to JD-Vcc jumper. Connect a separate +5 supply to "JD-Vcc" and board Gnd. This will supply power to the transistor drivers and relay coils. If relay isolation is enough for your application, connect Arduino +5 and Gnd, and leave Vcc to JD-Vcc jumper in place.

Operating Principal:

See the picture below: A is an electromagnet, B armature, C spring, D moving contact, and E fixed contacts. There are two fixed contacts, a normally closed one and a normally open one. When the coil is not energized, the normally open contact is the one that is off, while the normally closed one is the other that is on.

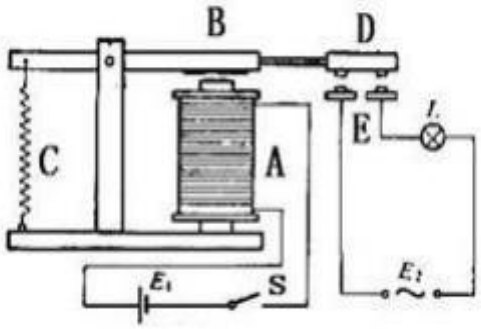


Fig.4.21: Operating Principal

Supply voltage to the coil and some currents will pass through the coil thus generating the electromagnetic effect. So, the armature overcomes the tension of the spring and is attracted to the core, thus closing the moving contact of the armature and the normally open (NO) contact or you may say releasing the former and the normally closed (NC) contact. After the coil is de-energized, the electromagnetic force disappears and the armature moves back to the original position, releasing the moving contact and normally closed contact. The closing and releasing of the contacts result in power on and off of the circuit.

Input:

VCC: Connected to positive supply voltage (supply power according to relay voltage)

GND: Connected to supply ground.

IN1: Signal triggering terminal 1 of relay module

IN2: Signal triggering terminal 2 of relay module

Output:

Each module of the relay has one NC (normally close), one NO (normally open) and one COM (Common) terminal. So, there are 2 NC, 2 NO and 2 COM of the channel relay in total. NC stands for the normal close port contact and the state without power. NO stands for the normal open port contact and the state with power. COM means the common port. You can choose NC port or NO port according to whether power or not. level is supplied to the signal terminal, you can see the LED will cycle between on and off.

Features:

The 2-Channel Relay Module includes the following features:

Table 4.8: Explanation of Relay

Number of Relays	2
Control Signal	TTL Level
Rated Load	7A/240VAC 10A/125VAC 10A/28VDC
Contact Action Time	10ms/5ms
Interface Board	5V 2-Channel Relay interface board, and each one need 15-20mA Driver Current.
Equipment	• Equipped with high-current relay, AC250V 10A; DC30V 10A • Indication LED's for Relay output status.
Supported Microcontrollers	Standard interface that can be controlled directly by microcontroller (Arduino, 8051, AVR, PIC, DSP, ARM, ARM, MSP430, TTL logic)

4.1.11: Power Supply

Almost all basic household electronic circuits need an unregulated AC to be converted to constant DC, in order to operate the electronic device. All devices will have a certain power supply limit and the electronic circuits inside these devices must be able to supply a constant DC voltage within this limit. That is, all the active and passive electronic devices will have a certain DC operating point (Q-point or Quiescent point), and this point must be achieved by the source of DC power. The DC power supply is practically converted to each and every stage in an electronic system. Thus, a common requirement for all these phases will be the DC power supply. All low power system can be run with a battery. But, for long time operating devices, batteries could prove to be costly and complicated. The best method used is in the form of an unregulated power supply –a combination of a transformer, rectifier and a filter. The diagram is shown below.

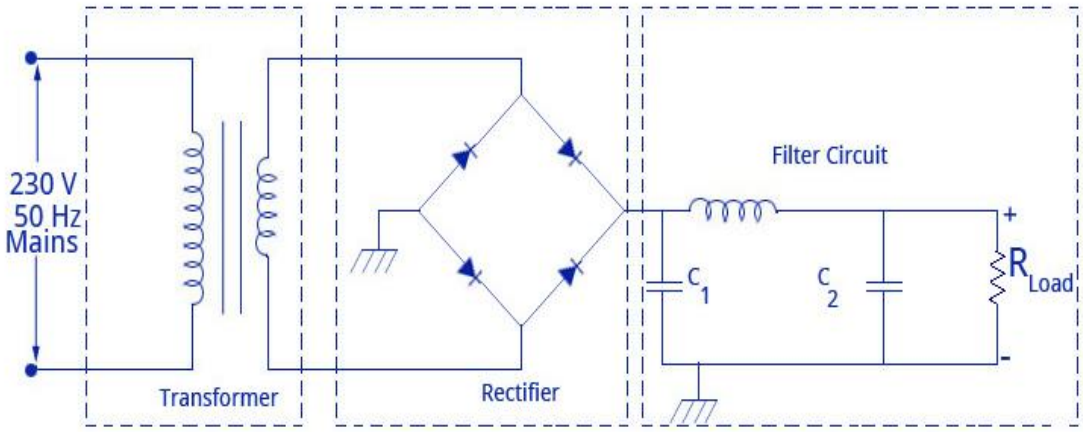


Fig.4.22: Block Diagram of Unregulated Power supply

As shown in the figure above, a small step-down transformer is used to reduce the voltage level to the devices needs. In India, a 1 Ø supply is available at 230 volts. The output of the transformer is a pulsating sinusoidal AC voltage, which is converted to pulsating DC with the help of a rectifier. This output is given to a filter circuit which reduces the AC ripples, and passes the DC components. But here are certain disadvantages in using an unregulated power supply.

Poor Regulation:

When the load varies, the output does not appear constant. The output voltage changes by a great value due to the huge change in current drawn from the supply. This is mainly due to the high internal resistance of the power supply (>30 Ohms).

AC Supply Main Variations:

The maximum variations in AC supply mains is give or take 6% of its rated value . But this value may go higher in some countries (180-280 volts). When the value is higher it's DC voltage output will differ largely.

Temperature Variation:

The use of semiconductor devices in electronic devices may cause variation in temperature.

These variations in dc output voltage may cause inaccurate or erratic operation or even malfunctioning of many electronic circuits. For instance, in oscillators the frequency will shift, in transmitters output will get distorted, and in amplifiers the operating point will shift causing bias instability.

All the above listed problems are overcome with the help of a voltage-regulator which is employed in conjunction with an unregulated power supply. Thus, the ripple voltage is largely reduced. Thus, the supply becomes a regulated power supply.

The internal circuitry of a regulated power supply also contains certain current limiting circuits which helps the supply circuit from getting fired from inadvertent circuits. Nowadays, all the power supplies use IC's to reduce ripples, enhance voltage regulation and for widened control options. Programmable power supplies are also available to allow remote operation that is useful in many settings.

REGULATED POWER SUPPLY:

Regulated power supply is an electronic circuit that is designed to provide a constant dc voltage of predetermined value across load terminals irrespective of ac mains fluctuations or load variations. As shown in the figure, the two main parts of a regulated power supply are a simple power supply and a voltage regulating device. The power supply output is given as input to the voltage regulating device that provides the final output. The voltage output of the power supply remains constant irrespective of large variations in the input AC voltage or output load current.

Given below is a circuit diagram of a regulated power supply circuit using a transistor series regulator as a regulating device The input AC voltage (230 Voltas Vrms), is supplied to a transformer. The output will be a stepped down ac output appropriate for the desired dc output. This ac voltage is then given to a bridge rectifier to produce a full-wave rectified output. This is then given to a pi-filter circuit to produce a dc voltage. The filter output may have some ac voltage variations and ripples. This is further filtered using a regulating circuit whose output will be a constant dc voltage. This regulated dc voltage is then given to a voltage divider, which supplies the different dc voltages that may be needed for different electronic circuits..

Power Supply Characteristics:

The quality of the power supply is determined by various characteristics like load voltage, load current, voltage regulation, source regulation, output impedance, ripple rejection, and so on. Some of the characteristics are briefly explained below.

Load Regulation:

The load regulation or load effect is the change in regulated output voltage when the load current changes from minimum to maximum value.

Load regulation = Vno-load – Vfull-load

Vno-load – Load Voltage at no load

Vfull-load – Load voltage at full load.

From the above equation we can understand that when Vno-load occurs the load resistance is infinite, that is, the out terminals are open circuited. Vfull-load occurs when the load resistance is of the minimum value where voltage regulation is lost.

% Load Regulation = [(Vno-load – Vfull-load)/Vfull-load] * 100

Minimum Load Resistance:

The value of I full-load, full load current should never increase than that mentioned in the data sheet of the power supply.

Source/Line Regulation:

In the block diagram, the input line voltage has a nominal value of 230 Volts but in practice, there are considerable variations in ac supply mains voltage. Since this ac supply mains voltage is the input to the ordinary power supply, the filtered output of the bridge rectifier is almost directly proportional to the ac mains voltage.

The source regulation is defined as the change in regulated output voltage for a specified rage of line voltage.

Output Impedance:

A regulated power supply is a very stiff dc voltage source. This means that the output resistance is very small. Even though the external load resistance is varied, almost no change is seen in the load voltage. An ideal voltage source has an output impedance of zero.

Ripple Rejection:

Voltage regulators stabilize the output voltage against variations in input voltage. Ripple is equivalent to a periodic variation in the input voltage. Thus, a voltage regulator attenuates the ripple that comes in with the unregulated input voltage. Since a voltage regulator uses negative feedback, the distortion is reduced by the same factor as the gain.

DC POWER SUPPLY:

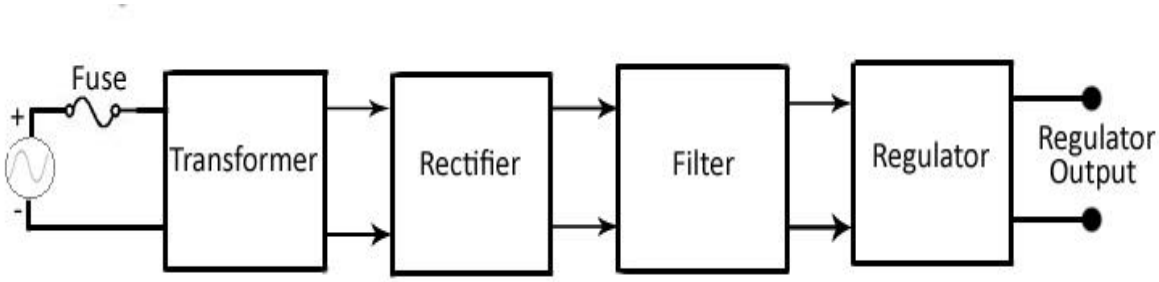


Fig.4.23: Block diagram of a power supply

An AC powered unregulated power supply usually uses a transformer to convert the voltage from the wall outlet (mains) to a different, nowadays usually lower, voltage. If it is used to produce DC, a rectifier is used to convert alternating voltage to a pulsating direct voltage, followed by a filter, comprising one or more capacitors, resistors, and sometimes inductors, to filter out (smooth) most of the pulsation. A small remaining unwanted alternating voltage component at mains or twice mains power frequency (depending upon whether half- or full-wave rectification is used) ripple is unavoidably superimposed on the direct output voltage.

The introduction of solid-state electronics, equipment used valves (vacuum tubes) which required high voltages; power supplies used step-up transformers, rectifiers, and filters to generate one or more direct voltages of some hundreds of volts, and a low alternating voltage for filaments. Only the most advanced equipment used expensive and bulky regulated power supplies.

4.2: Software Requirement

4.2.1: Arduino IDE

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

4.2.2: Hardware Specifications:

- Microcontroller: ATmega328
- Operating Voltage: 5V
- Input Voltage (recommended):7-12V

- Input Voltage (limits): 6- 20V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6 • DC Current per I/O Pin: 40 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB (ATmega328)
- SRAM: 2 KB (ATmega328)
- EEPROM: 1 KB (ATmega328)
- Clock Speed: 16 MHz

4.2.3: Board Types:

Various kinds of Arduino boards are available depending on different microcontrollers used. However, all Arduino boards have one thing in common: they are programmed through the Arduino IDE. The differences are based on the number of inputs and outputs (the number of sensors, LEDs, and buttons you can use on a single board), speed, operating voltage, form factor etc. Some boards are designed to be embedded and have no programming interface (hardware), which you would need to buy separately. Some can run directly from a 3.7V battery, others need at least 5V. Here is a list of different Arduino boards available.

Table.4.9: Arduino boards based on ATMEGA328 microcontroller

Board Name	Operating Volt	Clock Speed	Digital i/o	Analog Inputs	PWM	UART	Programming Interface
Arduino Uno R3	5V	16MHz	14	6	6	1	USB via ATMega16U2
Arduino Uno R3 SMD	5V	16MHz	14	6	6	1	USB via ATMega16U2
Red Board	5V	16MHz	14	6	6	1	USB via FTDI
Arduino Pro 3.3v/8 MHz	3.3V 8	8 MHz	14	6	6	1	FTDI Compatible Header
Arduino Pro 5V/16MHz	5V	16MHz	14	6	6	1	FTDI Compatible Header
Arduino mini 05	5V	16MHz	14	8	6	1	FTDI Compatible Header
Arduino Pro mini 3.3v/8mhz	3.3V	8MHz	14	8	6	1	FTDI Compatible Header
Arduino Pro mini 5v/16mhz	5V	16MHz	14	8	6	1	FTDI Compatible Header
Arduino Ethernet	5V	16MHz	14	6	6	1	FTDI Compatible Header
Arduino Fio	3.3V	8MHz	14	8	6	1	FTDI Compatible Header
LilyPad Arduino 328 main board	3.3V	8MHz	14	6	6	1	FTDI Compatible Header
LilyPad Arduino simply board	3.3V	8MHz	9	4	5	0	FTDI Compatible Header

4.2.3: Arduino board Description:

We will learn about the different components on the Arduino board. We will study the Arduino UNO board because it is the most popular board in the Arduino board family. In addition, it is the best board to get started with electronics and coding. Some boards look a bit different from the one given below, but most Arduino's have majority of these components in common.

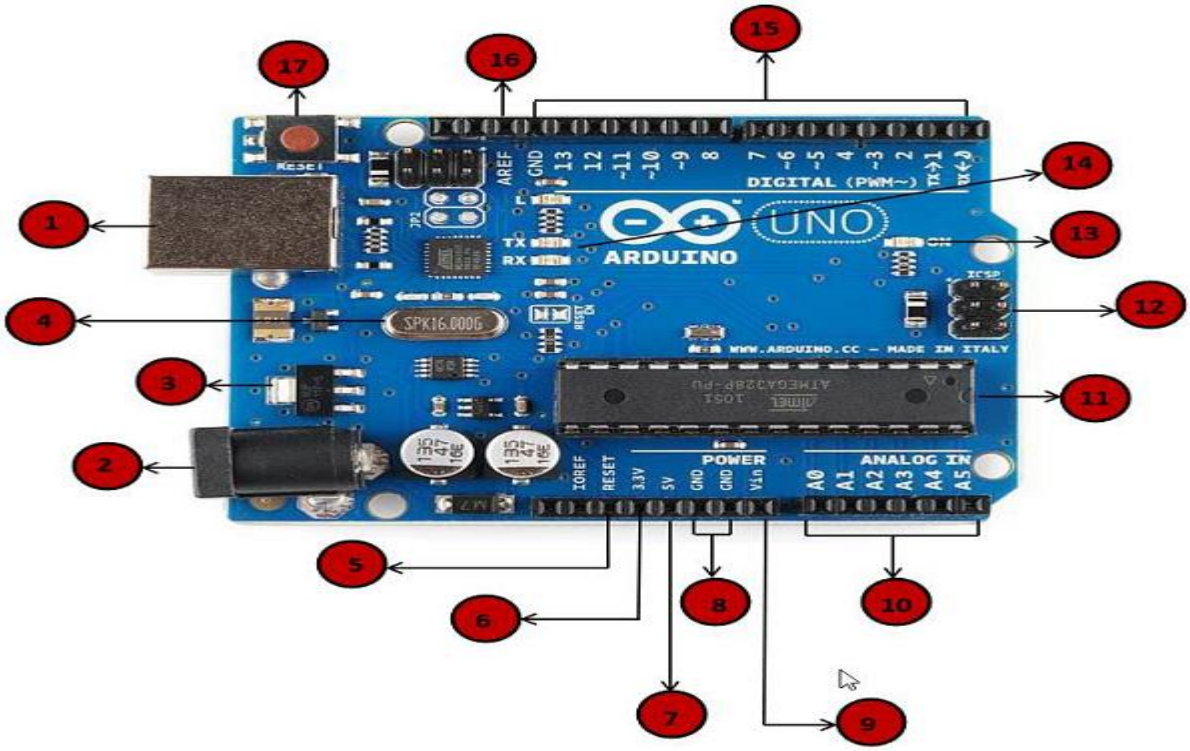


Fig.4.24: Arduino UNO board Description

1. Power USB:

Arduino board can be powered by using the USB cable from your computer. All you need to do is connect the USB cable to the USB connection (1).

2. Power (Barrel Jack):

Arduino boards can be powered directly from the AC mains power supply by connecting it to the Barrel Jack (2).

3. Voltage Regulator:

The function of the voltage regulator is to control the voltage given to the Arduino board and stabilize the DC voltages used by the processor and other elements.

4. Crystal Oscillator:

The crystal oscillator helps Arduino in dealing with time issues. How does Arduino calculate time? The answer is, by using the crystal oscillator. The number printed on top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16 MHz

5, 17. Arduino Reset:

You can reset your Arduino board, i.e., start your program from the beginning. You can reset the UNO board in two ways. First, by using the reset button (17) on the board. Second, you can connect an external reset button to the Arduino pin labeled RESET (5).

6, 7, 8, 9. Pins (3.3, 5, GND, Vin):

- 3.3V (6): Supply 3.3 output volt
- 5V (7): Supply 5 output volt
- Most of the components used with Arduino board works fine with 3.3 volt and 5 volts.
- GND (8) (Ground): There are several GND pins on the Arduino, any of which can be used to ground your circuit.
- Vin (9): This pin also can be used to power the Arduino board from an external power source, like AC mains power supply.

10. Analog pins:

The Arduino UNO board has five analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it into a digital value that can be read by the microprocessor.

11. Main microcontroller:

Each Arduino board has its own microcontroller (11). You can assume it as the brain of your board. The main IC (integrated circuit) on the Arduino is slightly different from board to board. The microcontrollers are usually of the ATMEL Company. You must know what IC your board has before loading up a new program from the Arduino IDE. This information is available on the top of the IC. For more details about the IC construction and functions, you can refer to the data sheet.

12. ICSP pin:

Mostly, ICSP (12) is an AVR, a tiny programming header for the Arduino consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often referred to as an SPI (Serial Peripheral Interface), which could be considered as an "expansion" of the output. Actually, you are slaving the output device to the master of the SPI bus.

13. Power LED indicator:

This LED should light up when you plug your Arduino into a power source to indicate that your board is powered up correctly. If this light does not turn on, then there is something wrong with the connection.

14. TX and RX LEDs:

On your board, you will find two labels: TX (transmit) and RX (receive). They appear in two places on the Arduino UNO board. First, at the digital pins 0 and 1, to indicate the pins responsible for serial communication. Second, the TX and RX led (13). The TX led flashes with different speed while sending the serial data. The speed of flashing depends on the baud rate used by the board. RX flashes during the receiving process.

15. Digital I / O:

The Arduino UNO board has 14 digital I/O pins (15) (of which 6 provide PWM (Pulse Width Modulation) output. These pins can be configured to work as input digital pins to read logic values (0 or 1) or as digital output pins to drive different modules like LEDs, relays, etc. The pins labeled "~" can be used to generate PWM.

16. AREF:

AREF stands for Analog Reference. It is sometimes, used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

4.2.4: Arduino Installation

After learning about the main parts of the Arduino UNO board, we are ready to learn how to set up the Arduino IDE. Once we learn this, we will be ready to upload our program on the Arduino board. In this section, we will learn in easy steps, how to set up the Arduino IDE on our computer and prepare the board to receive the program via USB cable.

Step 1:

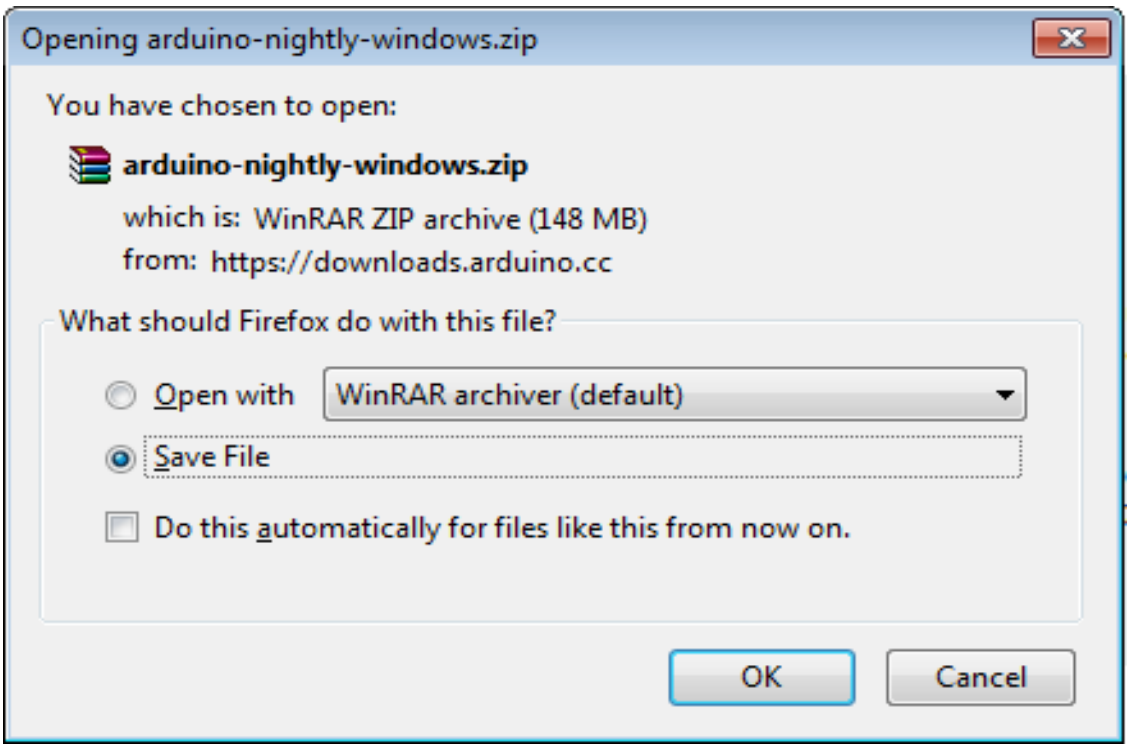
First you must have your Arduino board (you can choose your favorite board) and a USB cable. In case you use Arduino UNO, Arduino Duemilanove, Nano, Arduino

Mega 2560, or Diecimila, you will need a standard USB cable (A plug to B plug), the kind you would connect to a USB printer as shown in the following image.

Fig.4.25 : USB Cable

Step 2: Download Arduino IDE Software.

You can get different versions of Arduino IDE from the Download page on the Arduino Official website. You must select your software, which is compatible with your operating system (Windows, IOS, or Linux). After your file download is complete, unzip the file.



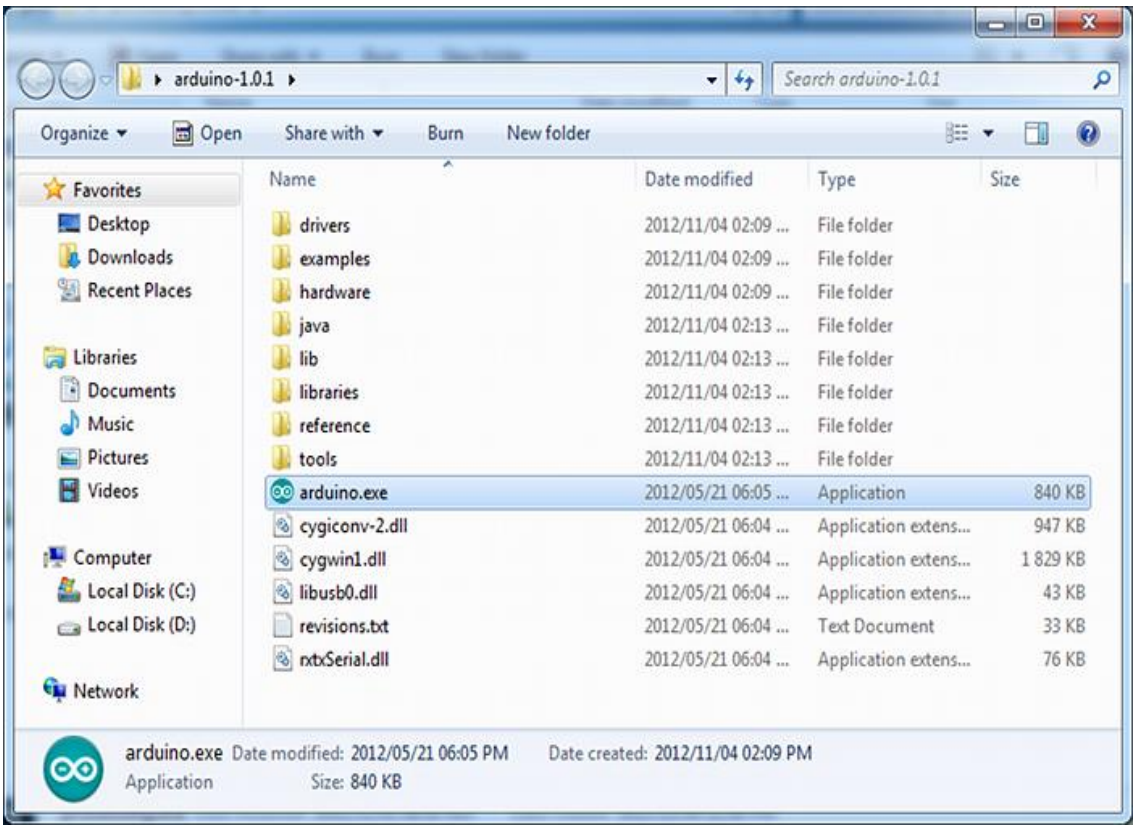
Step 3: Power up your board.

The Arduino Uno, Mega, Duemilanove and Arduino Nano automatically draw power from either, the USB connection to the computer or an external power supply. If you are using an Arduino Diecimila, you have to make sure that the board is configured to

draw power from the USB connection. The power source is selected with a jumper, a small piece of plastic that fits onto two of the three pins between the USB and power jacks. Check that it is on the two pins closest to the USB port. Connect the Arduino board to your computer using the USB cable. The green power LED (labeled PWR) should glow.

Step 4: Launch Arduino IDE

After your Arduino IDE software is downloaded, you need to unzip the folder. Inside the folder, you can find the application icon with an infinity label (application.exe). Double-click the icon to start the IDE.

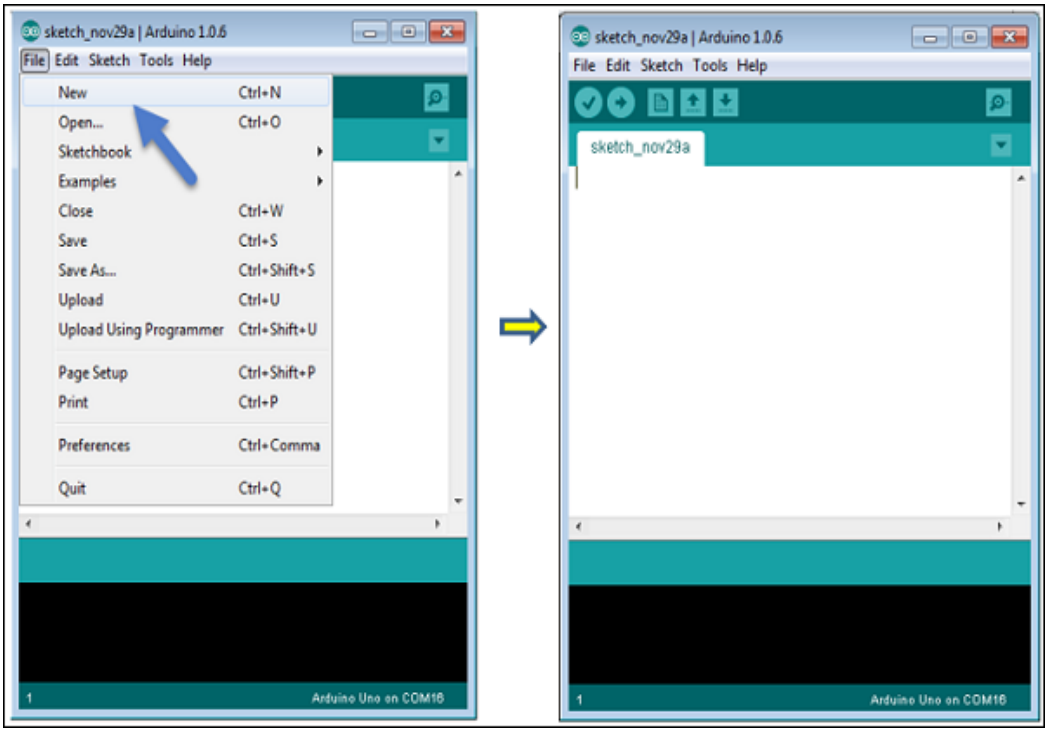


Step 5: Open your first project.

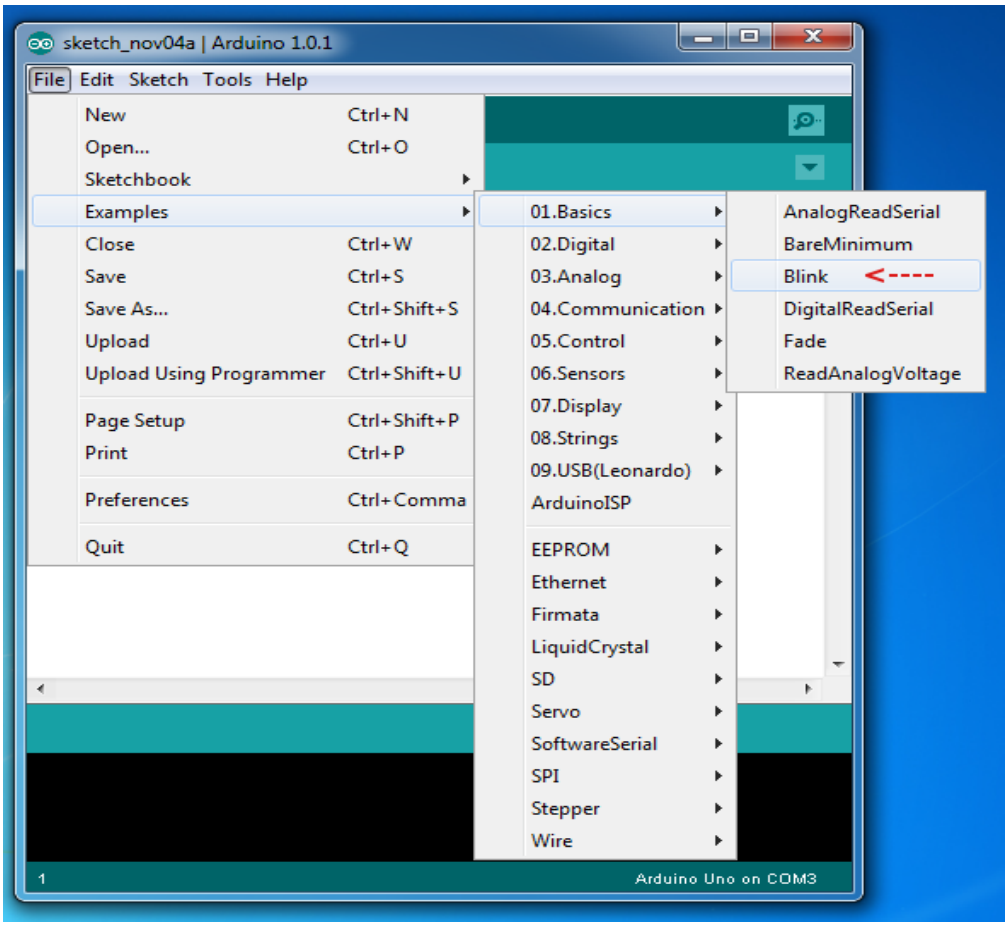
Once the software starts, you have two options:

- Create a new project.
- Open an existing project example.

To create a new project, select File --> New.



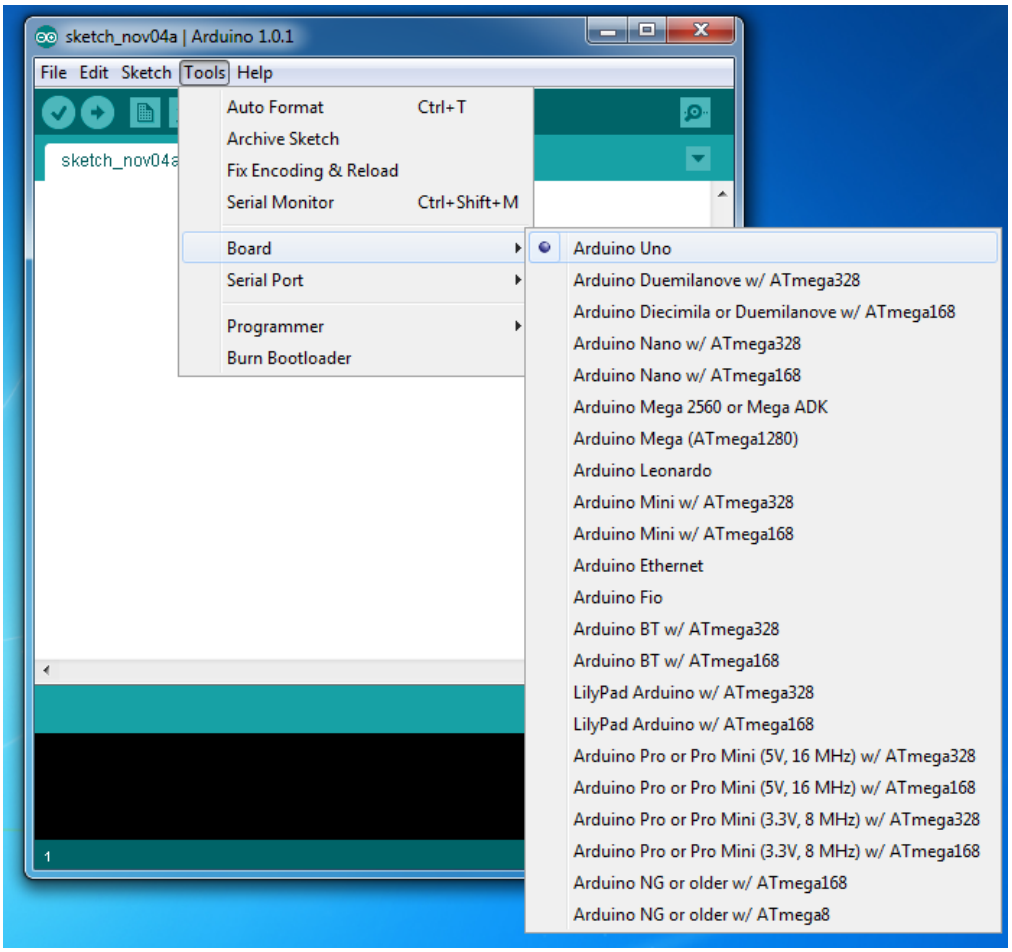
To open an existing project example, select File -> Example -> Basics -> Blink.



Here, we are selecting just one of the examples with the name Blink. It turns the LED on and off with some time delay. You can select any other example from the list.

Step 6: Select your Arduino board.

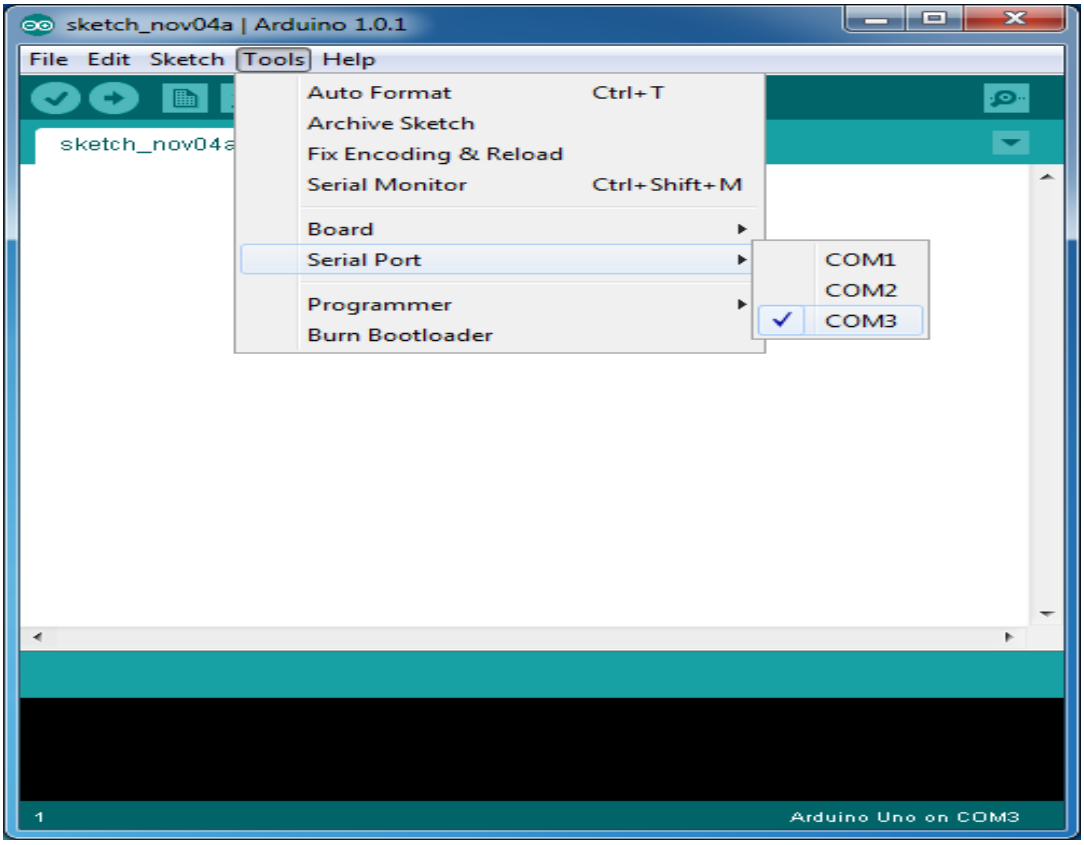
To avoid any error while uploading your program to the board, you must select the correct Arduino board name, which matches with the board connected to your computer. Go to Tools -> Board and select your board



Here, we have selected Arduino Uno board according to our tutorial, but you must select the name matching the board that you are using.

Step 7: Select your serial port.

Select the serial device of the Arduino board. Go to Tools -> Serial Port menu. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To find out, you can disconnect your Arduino board and re-open the menu, the entry that disappears should be of the Arduino board. Reconnect the board and select that serial port.



Step 8: Upload the program to your board.

Before explaining how we can upload our program to the board, we must demonstrate the function of each symbol appearing in the Arduino IDE toolbar.

Now, simply click the "Upload" button in the environment. Wait a few seconds; you will see the RX and TX LEDs on the board, flashing. If the upload is successful, the message "Done uploading" will appear in the status bar.
Note: If you have an Arduino Mini, NG, or other board, you need to press the reset button physically on the board, immediately before clicking the upload button on the Arduino Software.

4.3: Blynk

4.3.1: Introduction

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things.

Blynk is a platform with iOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets. It's really simple to set everything up and you'll start tinkering in less than 5 mins. Blynk is not tied to some specific board or shield. Instead, it's supporting hardware of your choice. Whether your Arduino or Raspberry Pi is linked to the Internet over Wi-Fi, Ethernet or this new ESP8266 chip, Blynk will get you online and ready for the Internet of Your Things.

Fig.4.26: Blynk app Overview

There are three major components in the platform:

- **Blynk App** - allows to you create amazing interfaces for your projects using various widgets we provide.
- **Blynk Server** - responsible for all the communications between the Smartphone and hardware. You can use our Blynk Cloud or run your private Blynk server locally. Its open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.
- **Blynk Libraries** - for all the popular hardware platforms - enable communication with the server and process all the incoming and out coming commands.

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things.
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- **Blynk Libraries** - for all the popular hardware platforms - enable communication with the server and process all the incoming and out coming commands.

Now imagine: every time you press a Button in the Blynk app, the message travels to the Blynk Cloud, where it magically finds its way to your hardware. It works the same in the opposite direction and everything happens in a blynk of an eye.

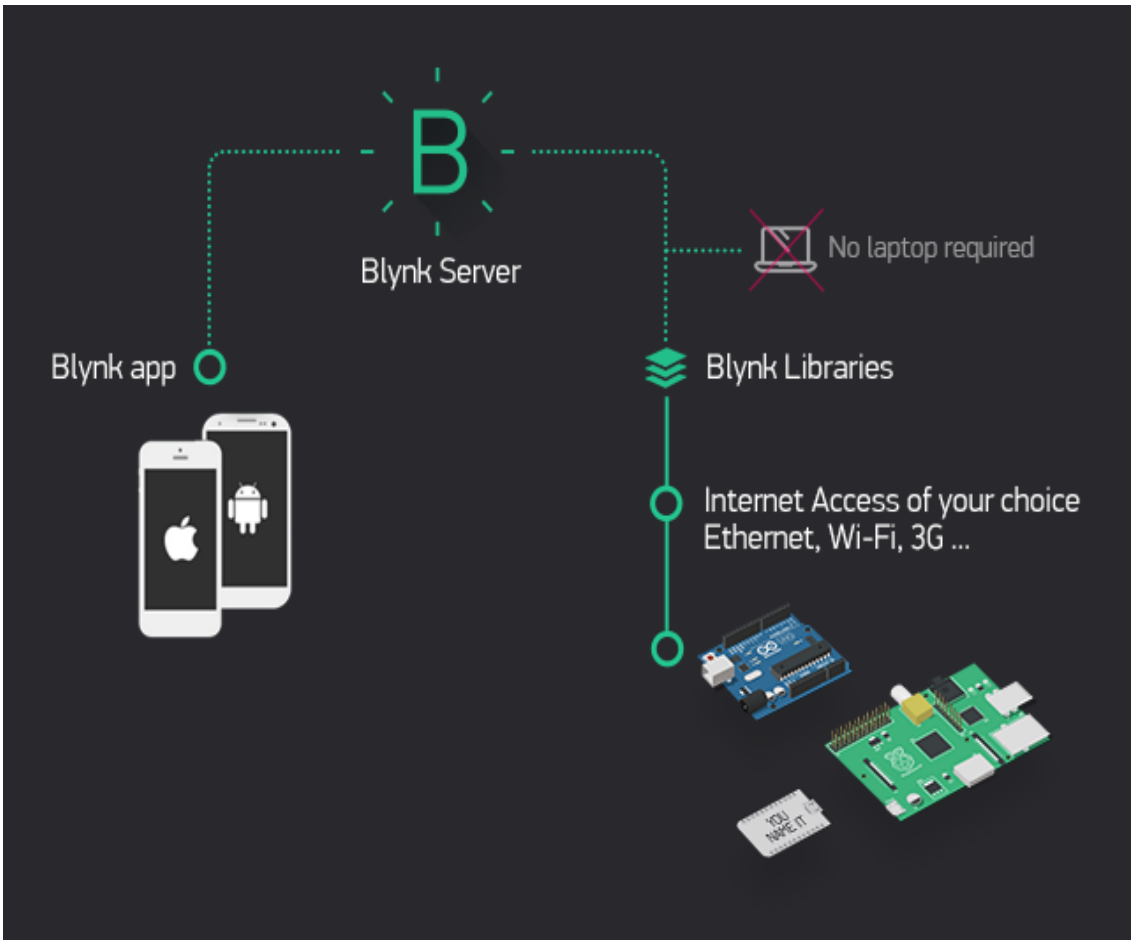

Fig.4.27: Blynk Connections

4.3.2: Features:

- Similar API & UI for all supported hardware & devices
- Connection to the cloud using:
  - Wi-Fi
  - Bluetooth and BLE
  - Ethernet
  - USB (Serial)
  - GSM
  - Set of easy-to-use Widgets
  - Direct pin manipulation with no code writing
  - Easy to integrate and add new functionality using virtual pins
- History data monitoring via History Graph widget
- Device-to-Device communication using Bridge Widget
- Sending emails, tweets, push notifications, etc.

4.3.3: Characteristics of Blynk

Similar API & UI for all supported hardware & devices Connection to the cloud can be done using Ethernet, Wi-Fi, Bluetooth, BLE and USB (Serial) Set of easy-to-use Widgets Direct pin manipulation with no code writing Easy to integrate and add new functionality using virtual pins History data monitoring via History Graph widget Device-to-Device communication using Bridge Widget Sending emails, tweets, push notifications, etc.

CHAPTER 5
RESULTS AND DISCUSSIONS

5.1: Introduction

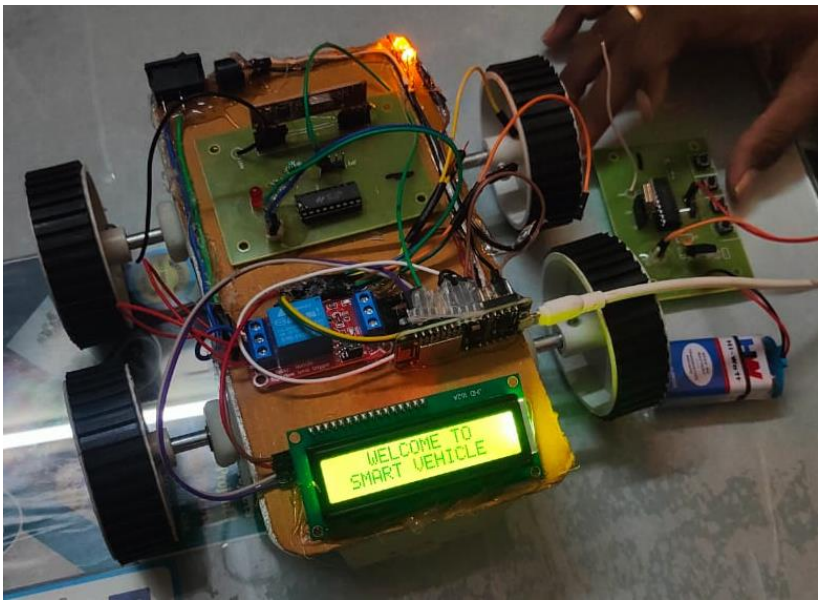

Fig.5.1: proposed system model

The proposed System prototype model which has RF Receiver for collecting the speed breaker information for alerting the vehicle driver.

5.2 Results

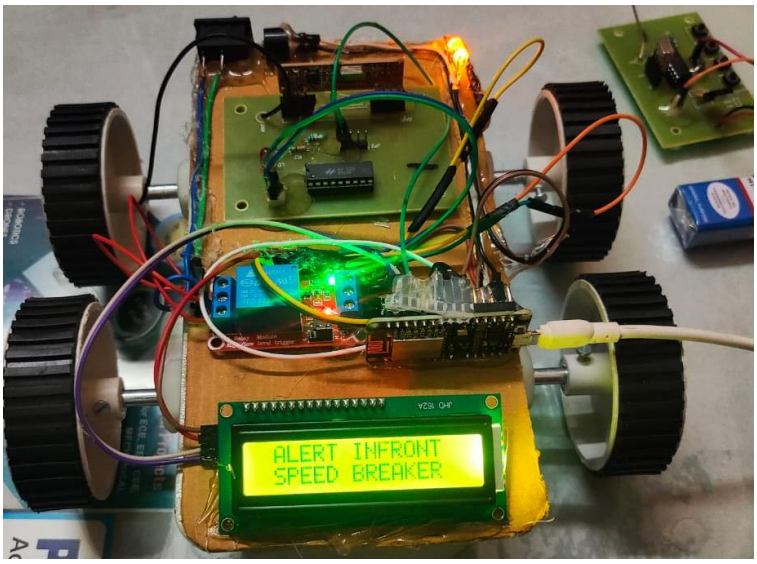

Fig.5.2: Detection of speed breaker using for proposed system

When ever the vehicle reaches nearer to speed breaker then immediately system will activate and it will display an alert message on lcd for indicating infront there is a speed breaker.

At the time of speed breaker detected our vehicle will slowdown automatically and to alert back side vehicles it will turn on Indicator light.

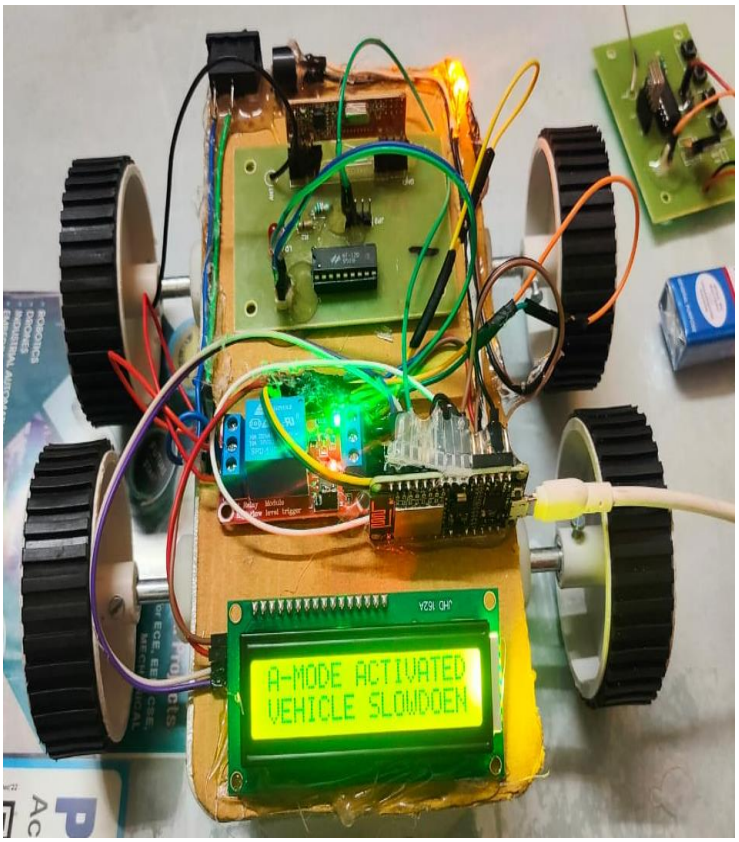

Fig.5.3: A-Mode activated vehicle slowdown

After detecting the speed breaker if driver is not responding to system, then automatically system will activate Auto Mode and vehicle will slow down.

CHAPTER 6
CONCLUSION & FUTURE WORK

6.1: Conclusion

The speed breaker allows the emergency vehicle to lower the pace, but this new flat speed breaker device plays the main role in safeguarding human lives by flattening the speed breaker. Transportation is easier and more convenient for emergency vehicle. This device will be introduced in future in most emergency situations, where emergency vehicles need to reach quickly with the help of solar energy.

6.2: Future Work

This project can implement to reduce the accidents at speed breakers, in future this project can also extended with multiple parameters using different sensors for safe journey.

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